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CNC CHARLESTON
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MISCELLANEOUS FILES REGARDING BIOREMEDIATION PILOT STUDY BUILDING NS-44 AND NS-45 CNC CHARLESTON SC
05/29/1998
NAVFAC SOUTHERN

L 6.5.98


**DEPARTMENT OF THE NAVY**
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
P.O. BOX 190010
2155 EAGLE DRIVE
NORTH CHARLESTON, S.C. 29419-9010


5090
Code 1849
29 May 1998



Mr. Paul Bristol
South Carolina Department of Health
And Environmental Control
Division of Underground Storage Tank
2600 Bull Street
Columbia, SC 29201

SUPPLEMENTAL REPORT ON THE BIOREMEDIATION PILOT STUDY OF UST SOIL

Dear Mr. Bristol:

Enclosed is the supplemental report on the bioremediation pilot study of UST soil at the former Naval Base Charleston, Charleston, SC. This report includes the data collected during the three months extension period granted by SCDHEC in a letter dated December 5, 1997.

Based on the clean-up levels in the Risk-Based Corrective Action for Petroleum Releases and the Soil Corrective Action Plan, dated January 28, 1997, the bioremediation effort is not feasible to continue. Southern Division recommends that the Bioremediation Pilot Study be discontinued at the former Charleston Naval Base.

If you have any questions please contact me at (843) 820-7307.

Sincerely,

Gabriel L. Magwood

GABRIEL L. MAGWOOD
Petroleum/UST Branch

Encl:
(1) Report on the Bioremediation Pilot Study

Supervisor of Shipbuilding, Conversion and Repair
USN, Portsmouth
Environmental Detachment Charleston
1899 North Hobson Avenue
North Charleston, SC 29405-2106
Attn. J.T. Amey

Re: Soil Corrective Action Plan/Response to Comments dated July 30, 1997
Charleston Naval Complex/Charleston Naval Base
Charleston, SC
Charleston County

Date: September 2, 1997

Dear Mr. Amey:

The author has completed technical review of the referenced document. The above responses have been provided to address Department concerns regarding the efficacy of the Soils Corrective Action Plan (SCAP) to determine appropriate levels of soils contamination below which would be protective of human health and the environment, as identified in correspondence dated April 18,1997 (Bristol to Amey). The intent of the SCAP document is to provide a Pass/Fail criteria for determining the extent of bioremediation necessary for contaminated soils generated during site closure activities. Concurrently, the author identifies the SCAP document as a tool by which the facility may determine the extent of soils excavation necessary during an UST/AST closure and reasonably identify sites which will potentially require additional assessments and/or remedial activities, as subsequently determined by the Department.

During review of the submitted responses, it was noted that wording utilized in reference to the current SCAP document is sufficient to significantly modify the soils concentrations proposed in the original document (dated July 18, 1996). The original document entitled "Plan For Excavated Soil From Petroleum Tank Sites" was presented as a SCAP for mitigating petroleum contaminated soils from UST site closures at the Charleston Naval Complex. The proposed methods of disposition for generated soils were based on the risk based screening levels (RBSL) Table 6 as outlined in the "Risk Based Corrective Action For Petroleum Releases" (RBCA) document (DHEC, June 1995). By correspondence dated October 17, 1996, (Bristol to Magwood) the author approved the above document with a request that petroleum compounds not identified by the RBCA document (specifically polynuclear aromatic hydrocarbons, PAH) be incorporated into the SCAP, with appropriate and reasonable concentrations for RBSL's. The facility provided an excerpt from the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) document, which provided proposed groundwater protection soil screening levels (SSL) for the remaining PAH compounds on December 6, 1996. By correspondence dated January 15, 1997, (Bristol to Dearhart) the author accepted the SSL's as proposed and agreed to incorporation with the previously approved SCAP. A revised SCAP document intended to detail the final approved version was submitted to the Department on February 6, 1997. This document refers to the RFI SSL's as the concentrations which the facility will utilize in the SCAP document, contrary to the original, approved document.

Based on the foregoing discussion, the author will initiate review of petroleum vessel closure reports as follows:

- Soil sample analytical results will be compared to Table B3 (Risk-Based Corrective Action for Petroleum Releases, DHEC June 20, 1997) Risk-Based Screening Levels (RBSL) for those chemical of concern (COC); remaining PAH compounds will be compared to the RFI SSL concentrations, as appropriate.

- As identified in the response to comments dated July 30, 1997, when Detection Limits (DL) are elevated and COC are reported as zero (0) or less than detection limit it will be assumed that the chemical constituents are equal to the elevated detection limit.

- As identified in the response to comments dated July 30, 1997, soil(s) with petroleum hydrocarbon compounds detected at or near the appropriate RBSL or SSL will not be placed (remain) within two (2) feet of the groundwater table.

With consideration to the SCAP for petroleum contaminated material, the Pass/Fail decision criteria for bioremediated soils will need to be consistent with the above comments. In this regard, the determination of when to cease soil bioremediation activities and declare the soils "ready for reuse" will incorporate the RBSL and SSL, as appropriate. Further, an appropriate tracking and reporting schedule should be developed which provides, at a minimum, the following information:

- Source and quantity of contaminated soils delivered to the remediation facility.

- Initial screening data.

- Initial mixing/treatment, as appropriate.

- Treatment process employed (air monitoring may be required for process "D").

- Final treatment analytical data.

- Final quantity and disposition of soil declared "ready for reuse".

It appears appropriate that a report describing the efficacy of the bioremediation process and incorporating the above information be submitted to my attention monthly during the duration of the demonstration period. Modification to this schedule may be considered subsequent to completion of the initial project duration.

Should you have any questions, please contact me at (803) 734-5328.

Sincerely,

Paul L. Bristol, Hydrogeologist
Groundwater Assessment and Development Section
Bureau of Water

cc: Trident District EQC

DHEC
PROMOTE PROTECT PROSPER
2600 Bull Street
Columbia, SC 29201-1708



December 5, 1997

Mr. Gabriel L. Magwood
Southern Division NFEC
P.O. Box 190010
2155 Eagle Drive
North Charleston, South Carolina 29419-9010

Re: Bioremediation Pilot Study Report dated October 14, 1997
Petroleum Contaminated Soils (Site Identification # 15405- General File)
Charleston Naval Complex/Charleston Naval Base
Charleston, SC
Charleston County

Dear Mr. Magwood:

The author has completed technical review of the referenced document. As submitted, the report provides a narrative describing activities and results of pilot study for petroleum contaminated soils at the referenced facility. Based on the data generated, the facility recommends extending the treatment period for an additional three (3) months. The author concurs with the conclusions and recommendation as provided. All activities and reporting requirements will continue as previously approved.

Should you have any questions, please contact me at (803) 734-5328.

Sincerely,
Paul L. Bristol
Paul L. Bristol, Hydrogeologist
Groundwater Quality Section
Bureau of Water

cc: Trident District EQC

# 15405 L 10.31.97
L 12.4.97

**DEPARTMENT OF THE NAVY**
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
P.O. BOX 190010
2155 EAGLE DRIVE
NORTH CHARLESTON, S.C. 29419-9010

5090
Code 1849
14 Oct 1997

RECEIVED
OCT 17 1997
Groundwater Assessment
and Development Section

Mr. Paul Bristol
South Carolina Department of Health
And Environmental Control
Ground-Water Protection Division
2600 Bull Street
Columbia, SC 29201

REPORT ON THE BIOREMEDIATION PILOT STUDY OF UST SOIL

Dear Mr. Bristol:

Enclosed is the report on the bioremediation pilot study of UST soil at the former Naval Base Charleston, Charleston, SC after a six-month duration. If you have any questions please contact me at (803) 820-7307.

Sincerely,

GABRIEL L. MAGWOOD
Petroleum/UST Branch

DHEC

PROMOTE PROTECT PROSPER

2600 Bull Street
Columbia, SC 29201-1708

Supervisor of Shipbuilding, Conversion and Repair
USN, Portsmouth
Environmental Detachment Charleston
1899 North Hobson Avenue
North Charleston, SC 29405-2106
Attn. J.T. Amey

Re: Soil Corrective Action Plan/Response to Comments dated July 30, 1997
Charleston Naval Complex/Charleston Naval Base
Charleston, SC
Charleston County

Date: September 2, 1997

Dear Mr. Amey:

The author has completed technical review of the referenced document. The above responses have been provided to address Department concerns regarding the efficacy of the Soils Corrective Action Plan (SCAP) to determine appropriate levels of soils contamination below which would be protective of human health and the environment, as identified in correspondence dated April 18,1997 (Bristol to Amey). The intent of the SCAP document is to provide a Pass/Fail criteria for determining the extent of bioremediation necessary for contaminated soils generated during site closure activities. Concurrently, the author identifies the SCAP document as a tool by which the facility may determine the extent of soils excavation necessary during an UST/AST closure and reasonably identify sites which will potentially require additional assessments and/or remedial activities, as subsequently determined by the Department.

During review of the submitted responses, it was noted that wording utilized in reference to the current SCAP document is sufficient to significantly modify the soils concentrations proposed in the original document (dated July 18, 1996). The original document entitled "Plan For Excavated Soil From Petroleum Tank Sites" was presented as a SCAP for mitigating petroleum contaminated soils from UST site closures at the Charleston Naval Complex. The proposed methods of disposition for generated soils were based on the risk based screening levels (RBSL) Table 6 as outlined in the "Risk Based Corrective Action For Petroleum Releases" (RBCA) document (DHEC, June 1995). By correspondence dated October 17, 1996, (Bristol to Magwood) the author approved the above document with a request that petroleum compounds not identified by the RBCA document (specifically polynuclear aromatic hydrocarbons, PAH) be incorporated into the SCAP, with appropriate and reasonable concentrations for RBSL's. The facility provided an excerpt from the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) document, which provided proposed groundwater protection soil screening levels (SSL) for the remaining PAH compounds on December 6, 1996. By correspondence dated January 15, 1997, (Bristol to Dearhart) the author accepted the SSL's as proposed and agreed to incorporation with the previously approved SCAP. A revised SCAP document intended to detail the final approved version was submitted to the Department on February 6, 1997. This document refers to the RFI SSL's as the concentrations which the facility will utilize in the SCAP document, contrary to the original, approved document.

Based on the foregoing discussion, the author will initiate review of petroleum vessel closure reports as follows:

- Soil sample analytical results will be compared to Table B3 (Risk-Based Corrective Action for Petroleum Releases, DHEC June 20, 1997) Risk-Based Screening Levels (RBSL) for those chemical of concern (COC); remaining PAH compounds will be compared to the RFI SSL concentrations, as appropriate.

L 8.21.97
L 8.21.97

**DEPARTMENT OF THE NAVY**
SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, USN
PORTSMOUTH, VIRGINIA, DETACHMENT ENVIRONMENTAL CHARLESTON
1899 NORTH HOBSON AVENUE, BUILDING 30
NORTH CHARLESTON, SOUTH CAROLINA 29405-2106

IN REPLY REFER TO:

Ser 794
July 30, 1997

South Carolina Department of Health
and Environmental Control
Bureau of Water
Groundwater Assessment and Development Section
2600 Bull Street
Columbia, South Carolina 29201
Attn: Paul L. Bristol

RECEIVED
AUG 01 1997
Groundwater Assessment and Development Section

Re: Comments on Soil Corrective Action Plan
Site Identification # 17787 and #17779

Dear Mr. Bristol,

Your letter of April 18, 1997, requested that the soil screening levels (SSLs) used in the Soil Corrective Action Plan (SCAP) be reevaluated. The need to reevaluate the SSLs is based on soil and groundwater sampling during the removal of UST NS-44 and UST NS-45 (Site Identification numbers 17787 and 17779) both at Building NS-44. The soil sample results indicated only low levels of petroleum contamination (less than the proposed SSLs). The groundwater samples from UST NS-45 indicated petroleum contamination, in the form of polynuclear aromatic hydrocarbons (PAHs) above the SSLs for groundwater. This raised the question that the SSLs for soil may not be protective of human health and the environment.

Your concerns over the adequacy of the SSLs was immediately brought to the attention of Mr. Magwood of Southern Division Naval Facilities Engineering Command. Mr. Magwood is the Project Manager for petroleum issues at the Charleston Naval Base. Mr. Magwood discussed your letter with Mr. Paul Bergstrand, the South Carolina Department of Health and Environmental Control representative to the Naval Base Charleston Environmental Clean-Up Project Team. It was agreed that the issue of using the SSLs as a pass/fail criteria could be addressed as a SCAP issue, but that the SSLs as outlined in Section 5.0, "Fate and Transport," of the Zone H RFI were accepted by the Base Environmental Project Team and should not be changed.

There are two explanations which may explain why the soil samples indicated relatively low levels of contamination while the groundwater was more severely impacted.

(1) - Two of the three soil samples taken during UST NS-45 removal indicated elevated detection levels (6,640 and 13,300 ug/kg) due to matrix interference. Several of the PAHs tested had SSLs which are lower than these detection levels (DLs), therefore what appeared to be low levels of petroleum hydrocarbons may have actually masked PAH levels greater than the SSLs referenced in the SCAP. When DLs are elevated and the chemicals of concern are zero or non-detect, then we must assume that the chemical constituents are equal to the elevated DLs. The only conclusion that can be drawn from the soil samples at the NS-45 site is that the PAHs are at or near 6,640 or 13,300 ug/kg at the respective sample locations. In fact, the relatively high DLs due to matrix interference should be interpreted as being contributed by the chemicals that are being tested.

(2) - Another explanation for how the contamination of the groundwater occurred without soil samples being grossly affected, concerns the pathway of the product's migration to the shallow groundwater. The supply and return piping exited the tank into a concrete cofferdam on top of the tank. From the cofferdam, the piping ran through a corrugated sleeve. The pipe sleeve and the cofferdam both contained oily residue and water. Leakage or petroleum weeping from the piping could have accumulated in the cofferdam and leaked down the side of the tank. This could provide a ready pathway to the shallow groundwater without significantly impacting soil 20-25 feet away at the tank ends. The area below the pipe sleeve is where the sample with the 13,300 ug/kg dilution level was taken.

As a matter of consistency in performing environmental work at the Charleston Naval Base, we intend to continue to use the RFI SSLs as a tool to evaluate options for soil removal, but this will include using elevated DLs in the evaluation. Returning soil to an excavation after tank removal is a common practice based on the state's UST Assessment Guidelines of June 1995. Sampling and using the SSLs to segregate impacted soils at the site is more protective of human health and the environment than just returning soil to the excavation. Regardless of any decision made concerning soil removal, each UST site is evaluated for closure or further assessment based on soil and groundwater samples from the tank pit during the removal process.

Ser.794
July 30, 1997

The question remains, should the detachment continue using the SSLs as a pass/fail criteria for returning soil to the environment after bioremediation? Based on our examination of the different variables at Building NS-44, and review of Section 5.0 of the RFI, we feel that we should continue to use the SSLs to determine when to cease soil bioremediation and accept the soil as "ready for reuse" and thus maintain consistency between RCRA operations and UST removals. Bioremediated soil with low level petroleum constituents at or near the SSL baseline could affect groundwater quality if the soil directly contacts the shallow groundwater. To help guard against this possibility, the reuse of bioremediated soil as back-fill will be limited to excavations where the bioremediated soil will not be used within two feet of groundwater. With your approval, this restriction will be included in the Soil Corrective Action Plan in the form of this letter.

If there are any questions or if more information is needed, please contact Jack Amey at (803) 743-6777 ext. 217 or Gabriel Magwood at (803) 820-7307.

Sincerely,

E. R. Dearhart
Director
Supervisor of Shipbuilding, Conversion and Repair, USN,
Portsmouth VA, Environmental Detachment Charleston, SC

cc: Gabriel Magwood, Southern Division

**SOUTHERN DIVISION**
**NAVAL FACILITIES ENGINEERING COMMAND**
**FACSIMILE**

THIS FACSIMILE CONTAINS THREE (3) PAGES
5 AUGUST 1997

**TO:** PAUL BRISTOL
SC DHEC

Telefax No.: 803-734-4661
Telephone No.: 803-734-5328

RECEIVED
AUG 0 6 1997
Groundwater Assessment
and Development Section

**FROM:** GABRIEL L. MAGWOOD
SOUTHERN DIVISION

Telefax No.: 803-820-7465
Telephone No.: 803-820-7307

**NOTE:**

1. Attached is the letter addressing TPH levels in petroleum contaminated soils.

2. Tony Hunt (RPM IR Program @ Southern Division) is meeting in Atlanta, GA. Wednesday, 6 August 1997, with the Charleston Project Team at EPA Headquarters, and would like to know if you agree with the first draft of the attached letter.

3. Please give me a call the morning of 6 August with your response so that I may contact Tony Hunt in Atlanta.

4. If you have any questions please contact me at 820-7307.

Discussed same this day

5090/11
Code 1877
25 July 1997

Mr. Paul Bristol
Bureau of Drinking Water Protection
Ground Water Protection Division
Assessment and Development Section
South Carolina Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201

Subj: MANAGEMENT OF PETROLEUM HYDROCARBON CONTAMINATED SOILS

Dear Mr. Bristol,

The purpose of this letter is to propose a method of management of petroleum contaminated soils at the Charleston Naval Complex. This management method is specifically for those soils which contain elevated levels of Total Petroleum Hydrocarbons (TPH) while other regulated constituents (BTEX, Napthalene, PAHS, or RCRA regulated constituents) are below the respective action levels. Because the chemical constituents in these soils are identical, the Navy proposes that the management of these soils should be the same regardless of the regulatory program which generates the soil and analytical results. In this regard, it is requested that the Department coordinate this request among regulatory programs to allow consistency in management and final disposition of these soils on site.

The measurement of TPH is derived from disposal requirements (i.e. suitability of landfilling) rather than a strict analytical method of determining contamination degree. However it is in dealing with soils that exceed an acceptable TPH value for landfilling that the Navy is assessing the management options. In discussions with Department personnel in the UST program (Bristol telecon, 7/24/97), Navy personnel (Tony Hunt, Gabe Magwood) questioned the usefulness of TPH as a indicator of contaminated soil especially when quantitative analysis of the regulated constituents (BTEX, Napthalene, PAHs and RCRA regulated constituents) were either non-detect or below actionable levels. Mr. Bristol agreed with this observation and acknowledged that TPH is a very generalized parameter and is difficult to use in assessing the degree of contamination because the value includes naturally occuring organics as well as lower molecular weight petroleum hydrocarbons that are not regulated. In application of this parameter as a means of determing the degree of contamination, Mr. Bristol indicated that extraordinarily high levels of TPH, generally above a 200 ppm range begin to attract attention and may cause problems if not properly managed. Soils with TPH levels above this range may be considered as fill material if the facility is confident that the soils would not contribute to further degradation of the area in which the soils are placed.

In discussions with Department personnel in the Land and Waste Management Section (Tapia telecon, 7/24/97) with Navy personnel (Tony Hunt) it was agreed that soils that contain elevated TPH levels and are below actionable levels for RCRA constituents should be managed in a protective way with bioremediation as an example. Soils which are segregated from visibly contaminated soils during Interim Measures and ultimately in Corrective Measures Implementation are examples of when soil of this type is generated. The soils across the base are geologically similar and therefore should be managed in a manner which is consistent with soils managed as petroleum contaminated in the UST program.

The Navy proposes the following management options for petroleum contaminated soils;

Criteria; These options apply to soils which have a TPH value above 100 ppm and have no other regulated constituent above an actionable level.

Option (1) - Soil with TPH levels below 500 ppm may be placed back in the excavation with no further action required based on the petroleum hydrocarbon content of these soils.

Option (2) - Soil exceeding a TPH level of 500 ppm may be bioremediated until TPH levels are reduce below this value. The soil may then be used as fill material on the facility.

Option (3) - Soil exceeding a TPH level of 500 ppm may be used as fill material at sites where other petroleum contamination exists and in which the fill material will not further degrade the site condition (i.e. TPH levels of the site exceed those of the fill material).

These options provide adequate flexibility in management of soils on site in addition to providing a protective means of addressing the TPH issue. We request that the Department review these options provide comment or approval as appropriate. If you should have any questions, please contact Gabe Magwood or myself at (803) 820-7307 and (803) 820-5525 respectively.

Sincerely,

M.A. HUNT
Environmental Engineer
Installation Restoration III

South Carolina
DHEC
Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201-1708



Supervisor of Shipbuilding, Conversion and Repair
USN, Portsmouth
Environmental Detachment Charleston
1899 North Hobson Avenue
North Charleston, SC 29405-2106
Attn. J.T. Amey

Re: Soil Corrective Action Plan
Charleston Naval Complex/Charleston Naval Base
Charleston, SC
Charleston County

Date: April 18, 1997

Dear Mr. Amey:

As you are aware, the author has been reviewing Underground Storage Tank (UST) Closure Assessment Reports utilizing the Soil Corrective Action Plan (SCAP) developed for the Bioremediation Study at Naval Base Charleston. The intent of the document is to provide a decision matrix for determining the extent of soil excavation necessary during an UST/AST closure and concurrently generate a Pass/Fail criteria for excavated soil disposition for bioremediation. Recent reviews of Closure Assessments for Buildings NS-45 (Site Identification #17787) and NS-44 (Site Identification #17779) indicate that low levels of petroleum hydrocarbons (less than the proposed RBSL'S) were detected in soil grab samples with shallow groundwater also impacted by petroleum constituents. With consideration to the above, it appears that the RBSL's established in the SCAP may not be protective of human health and the environment. The author requests that the facility reevaluate the referenced RBSL's and provide specific justification as to their potential usefulness in determining the severity of contamination (if any) and ability to provide sufficient protection to human health and the environment. It is anticipated that a report detailing the findings of the above request will be submitted to my attention on or before July 31, 1997. Closure Assessment Reports currently awaiting Department review will be held for comment pending a satisfactory conclusion to the above concern.

Should you have any questions, please contact me at (803) 734-5328.

Sincerely,

Paul L. Bristol, Hydrogeologist
Groundwater Assessment and Development Section
Bureau of Water

cc: Trident District EQC

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
P.O. BOX 190010
2155 EAGLE DRIVE
NORTH CHARLESTON, S.C. 29419-9010

Li 2.20.97
Lo 2.20.97

RECEIVED
FEB 06 1997
Groundwater Assessment and Development Section

15405

5090
Code 1849
4 Feb 1997

Mr. Paul Bristol
South Carolina Department of Health
and Environmental Control
Ground-Water Protection Division
2600 Bull Street
Columbia, SC 29201

**REVISED SOIL CORRECTIVE ACTION PLAN FOR CONTAMINATED SOIL AT THE CHARLESTON NAVAL COMPLEX**

Dear Mr. Bristol:

Enclosed is the revised soil corrective action plan (SCAP) for the underground storage tank sites at the Charleston Naval Complex, Charleston, South Carolina. The SCAP has been revised to incorporate the comments of the South Carolina DHEC letter dated October 17, 1996. Enclosure (3) lists DHEC comments and our responses to those comments. If you have any questions please contact me at (803) 820-7307.

Sincerely,

GABRIEL L. MAGWOOD
Petroleum/UST Branch

RECEIVED
FEB 06 1997
Groundwater Assessment
and Development Section

Memo Ser: 327
29 Jan 1997

MEMORANDUM

From: Director, Supervisor of Shipbuilding, Conversion and Repair, USN, Portsmouth Environmental Detachment Charleston, SC (SPORTENVDETCHASN)

To: Southern Division Naval Facilities Engineering Command (Code 1849 - Gabriel Magwood)

Subj: REVISED PLAN FOR EXCAVATED SOIL FROM PETROLEUM TANK SITES.

1. Please find attached the Detachment's revised Underground Storage Tank (UST) excavation Soil Corrective Action Plan. This plan has been updated to incorporate comments of South Carolina Department of Health and Environmental Control (DHEC) letter dated October 17, 1996. For information, the Detachment's specific response to each DHEC comment is also attached. Included in the update is the replacement of the risk based screening levels with Soil Screening Levels as proposed by our letter Ser: 252 dated December 4, 1996 and accepted by SCDHEC letter dated January 15, 1997. Any questions or concerns with this matter should be addressed to J. T. Amey, Environmental Detachment, at 743-6777, ext 217.

Respectfully,

ERDearhart

E. R. Dearhart

Copy to:
File

# SOIL CORRECTIVE ACTION PLAN FOR EXCAVATED SOIL FROM UNDERGROUND STORAGE TANKS (BIOREMEDIATION STUDY) NAVAL BASE CHARLESTON CHARLESTON SC



Prepared for:

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
CHARLESTON SC

Prepared by:

SUPERVISOR OF SHIPBUILDING, CONVERSION
AND REPAIR, USN, PORTSMOUTH
ENVIRONMENTAL DETACHMENT CHARLESTON
1899 NORTH HOBSON AVE.
NORTH CHARLESTON SC 29405-2106

January 28, 1997

# PLAN FOR EXCAVATED SOIL FROM PETROLEUM TANK SITES

Enclosure (1) Soil Screening Levels Tables
Enclosure (2) Volatile Organic Compounds Estimates

Supervisor of Shipbuilding, Conversion and Repair, USN, Portsmouth, VA, Environmental Detachment Charleston (DET) has been tasked to remove a large number of petroleum tanks as part of the Charleston Naval Base remediation program. All UST removals will be performed in accordance with South Carolina Department of Health and Environmental Control (DHEC) regulation R.61-92, Part 280 (Underground Storage Tank Control Regulations). The method for tank removal and assessment reporting will be as outlined in SC DHEC's "Underground Storage Tank Assessment Guidelines for Permanent Closure, Change-In-Owner and Change-In-Service," dated June, 1995.

Currently, the only soil removed from each UST site is the amount needed to remove the tank. With the initiation of the soil corrective action plan , UST excavations will be evaluated for further removal of petroleum contaminated soil. Where no structural or physical obstacles limit the size of the excavation, the pit will be examined for evidence of petroleum releases based on sight, smell, or condition of the tank. Field sampling using an Organic Vapor Analyzer (OVA) for headspace analysis will determine if further soil needs to be removed from the excavation. OVA readings of greater than 250 parts per million will result in further excavation of the contaminated soil. Where feasible, the pit will be left open until laboratory analysis are obtained.

During the tank removal process, a significant amount of soil will be excavated. The proposed methods of disposition of the soil are based on Soil Screening Levels (SSL) previously established by Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) documents for the Charleston Naval Complex. The RFI tables of chemicals and SSL are based on the Environmental Protection Agency Region III Risked-Based Concentration Table dated March 1995. Soils from the tank excavation will be sampled for the following chemicals of concern (COC):

benzene, toluene, ethylbenzene, xylenes, acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(ghi)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, fluoranthene, fluorene, indeno(1,2,3,-c,d)pyrene, naphthalene, phenanthrene, and pyrene.

The sample results will be compared to SSL in Tables 5.2.1/5.3.1 of the RFI document for NAVBASE-Charleston, Zone H,( Enclosure 1).

The following actions will be taken based on the COC concentrations in the excavated soils:

(a) All COC below the SSL and no known non-petroleum contaminants -- no remediation required, soil will be returned to the excavation.

(b) Any COC above the SSL and no known non-petroleum contaminants -- bioremediate to levels below the SSL and reuse.

(c) Known non-petroleum contaminants exceeding an applicable limit or if option (a) or (b) is not desirable -- transfer to a contractor for disposal as waste.

Soils excavated from waste oil UST sites will not be initially considered for bioremediation. If the COC are below the SSL and all metals are below RCRA limits, the soil be returned to the excavation. If any COC are above the SSL, or one or more metals are above the RCRA limits, the soil will be disposed of as waste per South Carolina Code of Regulations (R.) 61-79.261.

Excavated soils which are determined to be waste will be accumulated on site in containments at Building 1601 prior to disposal. These waste soils will be segregated based on the type of contamination. Soils that are contaminated with petroleum products (BTEX, and PAH) will be separated from soils that are contaminated with other RCRA constituents. All waste soils will be properly disposed of at a DHEC permitted treatment or disposal facility.

For the bioremediation phase of this plan, DET proposes using a unique approach. A standard bioremediation plan requires a detailed treatment method for an excavation site based on predetermined contamination and soil conditions, as well as other site specific information. Due to the number of sites, the small quantities (as little as a few cubic feet) of soil from most sites, and the nonavailability of most site specific data until after tank removal, normal procedures for establishing a bioremediation plan would prohibit bioremediation as a feasible treatment. Therefore the following plan is submitted.

The major elements of this plan include:

PURPOSE:

Determine the feasibility of the bioremediation of petroleum contaminated soil excavated in small lots from various sites to a cleanup level of at least the SSL identified in Enclosure (1).

SOIL:

Only petroleum contaminated soil not known or suspected of other contamination would be treated. Soil meeting this requirement may also be rejected based on some characteristic (i.e., clay content, concentration level, etc.). Waste or used oil impregnated soil would not be treated based on the probability of other contamination being present (i.e., heavy metals). Gasoline contaminated soil may be excluded depending on the effect of the increased volatile organic compound (VOC) rate on monitoring and ventilation.

SITE:

To minimize runoff problems, the bioremediation will be done in Building 1601, a well ventilated fully enclosed 80,000 sq ft warehouse. The building has a concrete floor and is constructed such that portions of the foundation will serve as a sufficient berm.

Site preparations will include:

(a) removal of deteriorated lead based paint from the ceiling and interior walls
(b) operational testing of the ventilation system
(c) inspection/repair of any obvious floor cracks
(d) installation of overhead irrigation system

Due to site construction a liner is not considered necessary and, where tilling operations are proposed, would not be practical. Any runoff/leachate will be collected using a simple vacuum process. Any collected leachate will be immediately returned to the soil being treated based on moisture level or temporarily stored and then returned. No sampling/analysis is considered necessary. In the event the stored leachate becomes excessive, sampling for compliance with National Pollutant Discharge Elimination System(NPDES) requirements will be performed. If the sample is in compliance, the leachate will be discharged to the North Charleston Publicly Owned Treatment Works. Otherwise, the leachate will be evaluated for alternate disposition.

The existing ventilation system will produce a ground level discharge which is considered acceptable. Also, based on expected VOC levels, Enclosure (2), being considerably less than 1000 lbs/month, an air permit is not considered to be required. No other permits are considered applicable.

PROCESS:

Initial Screening - Each lot (minimum of 10 cubic yards from one or more sites) will be sampled (if not already done during excavation) to determine contamination levels and soil conditions.

Mixing/Initial Treatment - based on the above results, pH may be adjusted and other soil condition improvements made. These could include adding nutrients, water, and/or compost (manure, wood chips, or other material). The treated lot will be mixed to obtain a more homogeneous soil matrix and then placed as a windrow/pile. Planned size of a windrow/pile: up to two foot deep with width and length to suit.

Treatment - use any method below after establishing the windrow/pile. A minimum of one windrow/pile for each method used will be established.

Method A: tilling at least once per month

Method B: tilling at least once per month and maintaining moisture control (based on visual inspection or sampling)

Method C: same as method B plus the monitoring and adjustment of various soil conditions which may include nutrients content, pH, microbial population and/or others.

Method D: (OPTIONAL) same as method C except air will be supplied to/extracted from the windrow without tilling. This will be accomplished using a piping system within the windrow/pile connected to an appropriately sized blower assembly.

SAMPLING/MONITORING:

Safety - The levels of volatile and semi-volatile compound concentrations are not expected to present any hazards or require any personal protection equipment (PPE). However, PPE will be used until air monitoring performed during initial operations prove otherwise.

Soil -Prior to starting the treatment period, a minimum of one composite sample will be taken of the new lot and analyzed for the COC.
During treatment, immunoassy technology will be used to monitor for total petroleum hydrocarbons (TPH) and/or PAH. This method of testing will be used due to the significant cost reduction of testing to provide an indication of the bioremediation progress. Optional sampling/monitoring for soil nutrient conditions, pH, oxygen/ carbon dioxide, moisture, and microbial population may be done dependent on the method and other factors. Also for method D, the extracted air may be monitored for various conditions (i.e., oxygen, carbon dioxide, etc.).

For final testing of the soil in each windrow/pile, a minimum of one composite sample per 10 cubic yards will be taken. Final testing will be analyzed for the COC by a state certified laboratory.
Soil at or less than the SSL will be considered acceptable for unrestricted reuse. For soil not meeting these levels, additional bioremediation will the performed and the soil retested or the soil may be transferred to a contractor for disposal as waste.

DURATION:

The duration for this project is for up to six months, during and after which the results will be evaluated to determine the best methodology. Based on this evaluation a new plan for continued and/or expanded operation will be submitted.

Table 5.2.1
Fate and Transport Properties and Screening Levels for
Constituents Detected in Soil and Groundwater
NAVBASE-Charleston, Zone H

| Parameter | Vapor Pressure (mm Hg) | Density (g/cm3) | Solubilit (mg/L) | Henry's Law Constant (atm-m3/ mole) | Organic Carbon Water Part. Coeff. (L/kg) | Salt Water Chronic WQC ! (ug/L) | Tap Water RBC or UTL * | Water Units | | Ground Water Protection SSL or UTL ** | Soil Units | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.6E-03 | 1.0E+00 | 3.5E+00 | 1.70E-04 | 1.78E+01 | NDA | 220 | UG/L | a | 20000 | UG/KG | a,b |
| Acenaphthylene | 2.9E-02 | 9.0E-01 | 3.9E+00 | 2.00E-04 | 3.97E+01 | NDA | 220 | UG/L | c | 20000 | UG/KG | c |
| Acetone | 2.7E+02 | 7.9E-01 | 1.0E+06 | 3.97E-05 | 3.70E-01 | NDA | 370 | UG/L | a | 800 | UG/KG | a,b |
| Acetonitrile | 8.8E+01 | 7.9E-01 | NDA | 2.93E-05 | 4.80E-01 | NDA | 22 | UG/L | a | 70 | UG/KG | n |
| Acrylonitrile | 1.0E+02 | 8.0E-01 | 7.9E+04 | 1.10E-04 | 7.40E-02 | NDA | 0.12 | UG/L | | 0.04 | UG/KG | n |
| Aldrin | 6.0E-06 | 1.7E+00 | 2.7E-02 | 2.67E-05 | 4.07E+02 | NDA | 0.004 | UG/L | | 5 | UG/KG | |
| Aluminum | NA | NA | NA | NA | NA | NDA | 3700 | UG/L | a | 46180 | MG/KG | d |
| Ammonia | NDA | NDA | NDA | NDA | NDA | NDA | 34 | MG/L | | NDA | | |
| Anthracene | 2.0E-04 | 1.3E+00 | 4.5E-02 | 6.50E-05 | 1.86E+04 | NDA | 1100 | UG/L | a | 430000 | UG/KG | a,b |
| Antimony | NA | NA | NA | NA | NA | NDA | 1.5 | UG/L | a | NDA | | |
| Aroclor-1248 | 4.9E-04 | 1.4E+00 | 5.4E-02 | 3.50E-03 | 4.37E+05 | 0.03 | 0.0087 | UG/L | | 8200 | UG/KG | |
| Aroclor-1254 | 7.7E-05 | 1.5E+00 | 5.0E-02 | 2.70E-03 | 4.31E+05 | 0.03 | 0.0087 | UG/L | | 8200 | UG/KG | |
| Aroclor-1260 | 4.1E-05 | 1.6E+00 | 8.0E-02 | 7.10E-03 | 8.22E+05 | 0.03 | 0.0087 | UG/L | | 8200 | UG/KG | |
| Arsenic | NA | NA | NA | NA | NA | 36 | 27.99 | UG/L | d | 35.52 | MG/KG | d |
| Azobenzene | NDA | NDA | NDA | NDA | NDA | NDA | 0.61 | UG/L | | NDA | | |
| beta-BHC | 2.8E-07 | 1.9E+00 | 2.4E-01 | 2.30E-07 | 2.48E+03 | NDA | 0.037 | UG/L | | 2 | UG/KG | |
| alpha-BHC | 2.5E-05 | 1.9E+00 | 1.6E+00 | 5.30E-06 | 1.82E+03 | NDA | 0.011 | UG/L | | 0.4 | UG/KG | |
| delta-BHC | 1.7E-05 | 1.9E+00 | 3.1E-01 | 2.50E-07 | 1.50E+03 | NDA | 0.052 | UG/L | e | 6 | UG/KG | e |
| gamma-BHC (Lindane) | 6.7E-05 | 1.6E+00 | 7.5E+00 | 3.25E-06 | 1.21E+03 | NDA | 0.052 | UG/L | | 6 | UG/KG | |
| Barium | NA | NA | NA | NA | NA | NDA | 323 | UG/L | d | 43.8 | MG/KG | d |
| Benzene | 9.5E+01 | 8.7E-01 | 1.8E+03 | 5.40E-03 | 5.00E+01 | NDA | 0.36 | UG/L | | 20 | UG/KG | 7ug/kg |
| Benzidine | 5.0E-04 | 1.3E+00 | 4.0E+02 | 3.88E-11 | 3.98E+01 | NDA | 0.00029 | UG/L | | 0.0011 | UG/KG | |
| Benzo(g,h,i)perylene | 1.0E-10 | NDA | 2.6E-04 | 1.40E-07 | 7.76E+06 | NDA | 150 | UG/L | f | 98000 | UG/KG | f |
| Benzo(a)pyrene Equivalents * | 5.6E-09 | 1.4E+00 | 3.9E-03 | 2.40E-06 | 1.77E+06 | NDA | 0.0092 | UG/L | | 4000 | UG/KG | |
| Benzoic acid | 1.0E+00 | 1.3E+00 | 3.4E+03 | 7.02E-07 | 1.82E+02 | NDA | 15000 | UG/L | a | 28000 | UG/KG | a,b |
| Beryllium | NA | NA | NA | NA | NA | NDA | 0.016 | UG/L | | 180 | MG/KG | |
| Bromomethane | 1.6E+03 | 1.7E+00 | 1.3E+04 | 2.00E-01 | 8.32E+01 | NDA | 0.87 | UG/L | a | 10 | UG/KG | a,b |
| 4-Bromophenyl-phenylether | 1.5E-03 | 1.4E+00 | NDA | 1.00E-04 | 8.71E+04 | NDA | 210 | UG/L | a | 36600 | UG/KG | |
| 2-Butanone (MEK) | 7.8E+01 | 8.1E-01 | 2.7E+05 | 4.66E-05 | 1.23E+00 | NDA | 190 | UG/L | a | 570 | UG/KG | n |
| Butylbenzylphthalate | 8.6E-06 | 1.1E+00 | 2.8E+00 | 1.30E-06 | 1.51E+02 | NDA | 730 | UG/L | a | 6800 | UG/KG | a,b |
| Cadmium | NA | NA | NA | NA | NA | 9.3 | 1.8 | UG/L | a | 6 | MG/KG | h |
| Carbon disulfide | 3.0E+02 | 1.3E+00 | 2.1E+03 | 1.33E-02 | 2.95E+02 | NDA | 2.1 | UG/L | a | 1400 | UG/KG | a,b |
| alpha-Chlordane | 1.0E-05 | 1.6E+00 | 5.6E-02 | 4.80E-05 | 4.95E+04 | 0.004 | 0.052 | UG/L | | 2000 | UG/KG | |
| gamma-Chlordane | 1.0E-05 | 1.6E+00 | 5.6E-02 | 4.80E-05 | 4.95E+04 | NDA | 0.052 | UG/L | | 2000 | UG/KG | |
| Chlorobenzene | 1.0E+01 | 1.1E+00 | 4.9E+02 | 3.93E-03 | 1.73E+02 | NDA | 3.9 | UG/L | a | 60 | UG/KG | a,b |
| Chlorobenzilate | 2.2E-06 | NDA | 1.3E+01 | 7.24E-08 | 1.07E+03 | NDA | 0.25 | UG/L | | 0.6 | UG/KG | n |
| Chloroethane | 1.0E+03 | 9.0E-01 | 5.7E+03 | 1.00E-02 | 3.47E+00 | NDA | 860 | UG/L | a | 3300 | UG/KG | a,b |
| bis(2-Chloroethyl)ether | 1.2E+00 | 1.2E+00 | 1.0E+04 | 1.30E-05 | 1.41E+01 | NDA | 0.0092 | UG/L | | 0.3 | UG/KG | |
| Chloroform | 1.6E+02 | 1.5E+00 | 8.0E+03 | 3.23E-03 | 4.60E+01 | NDA | 0.15 | UG/L | | 300 | UG/KG | |
| Chloromethane | 3.8E+03 | 9.2E-01 | 7.3E+03 | 8.82E-03 | 2.51E+01 | NDA | 1.4 | UG/L | | 6.6 | UG/KG | |
| 4-Chloro-3-methylphenol | 5.0E-02 | NDA | 3.9E+03 | 1.78E-06 | 7.76E+02 | NDA | NDA | | | NDA | | |
| 2-Chlorophenol | 1.4E+00 | 1.3E+00 | 2.8E+04 | 8.28E-06 | 3.63E+02 | NDA | 18 | UG/L | a | 200 | UG/KG | a,b |
| Chromium | NA | NA | NA | NA | NA | 50 | 18 | UG/L | a | 85.65 | MG/KG | d |
| Cobalt | NA | NA | NA | NA | NA | NDA | 220 | UG/L | a | 14.88 | MG/KG | d |
| Copper | NA | NA | NA | NA | NA | 2.9 | 140 | UG/L | a | 31.62 | MG/KG | d |
| Cyanide | NA | NA | NA | NA | NA | 1 | 75 | UG/L | a | NDA | | |
| 2,4-D | 1.1E-02 | 1.4E+00 | 6.8E+02 | 1.37E-10 | 1.58E+00 | NDA | 6.1 | UG/L | a | 1700 | UG/KG | h |
| 2,4-DB | NDA | NDA | NDA | NDA | NDA | NDA | 29 | UG/L | a | 1000 | UG/KG | r |
| 4,4'-DDD | 1.0E-06 | 1.5E+00 | 2.0E-02 | 2.16E-05 | 4.37E+04 | NDA | 0.28 | UG/L | | 700 | UG/KG | |
| 4,4'-DDE | 6.5E-06 | | 4.0E-02 | 2.34E-05 | 2.45E+05 | NDA | 0.2 | UG/L | | 500 | UG/KG | |
| 4,4'-DDT | 1.9E-07 | 1.6E+00 | 5.0E-03 | 4.89E-05 | 3.87E+05 | 0.001 | 0.2 | UG/L | | 1000 | UG/KG | |
| DCAA | NDA | NDA | NDA | NDA | NDA | NDA | NDA | | | NDA | | |
| Dibenzofuran | NDA | 1.1E+00 | 1.0E+01 | NDA | 1.00E+04 | NDA | 15 | UG/L | a | 12000 | UG/KG | a,b |
| Dibromochloromethane | 7.6E+01 | 2.5E+00 | 4.0E+03 | 9.90E-04 | 8.32E+01 | NDA | NDA | | | 38 | UG/KG | p |

* see Pg 4 of 4 for BEQ specific levels

Table 5.2.1
Fate and Transport Properties and Screening Levels for
Constituents Detected in Soil and Groundwater
NAVBASE-Charleston, Zone H

| Parameter | Vapor Pressure (mm Hg) | Density (g/cm3) | Solubilit (mg/L) | Henry's Law Constant (atm-m3/ mole) | Organic Carbon Water Part. Coeff. (L/kg) | Salt Water Chronic WQC ! (ug/L) | Tap Water RBC or UTL * | Water Units | | Ground Water Protection SSL or UTL ** | Soil Units | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Di-n-butylphthalate | 1.0E-05 | 1.0E+00 | 1.3E+01 | 6.30E-05 | 1.38E+03 | NDA | 370 | UG/L | a | 12000 | UG/KG | a,b |
| 1,2-Dichlorobenzene | 1.0E+00 | 1.3E+00 | 1.0E+02 | 1.90E-03 | 1.82E+02 | NDA | 27 | UG/L | a | 600 | UG/KG | h |
| 1,4-Dichlorobenzene | 6.0E-01 | 1.2E+00 | 7.9E+01 | 3.10E-03 | 5.11E+02 | NDA | 0.44 | UG/L | | 1000 | UG/KG | h |
| 1,3-Dichlorobenzene | 2.3E+00 | 1.3E+00 | 1.2E+02 | 3.60E-03 | 1.70E+02 | NDA | 54 | UG/L | a | 600 | UG/KG | g |
| 1,2-Dichloroethane | 6.4E+01 | 1.3E+00 | 8.7E+03 | 9.80E-04 | 1.41E+01 | NDA | 0.12 | UG/L | | 10 | UG/KG | |
| 1,1-Dichloroethane | 1.8E+02 | 1.2E+00 | 5.5E+03 | 5.45E-03 | 3.40E+01 | NDA | 81 | UG/L | a | 1100 | UG/KG | |
| 1,2-Dichloroethene (total) | 3.0E+02 | NDA | 3.5E+03 | 5.00E-03 | 2.30E-02 | NDA | 5.5 | UG/L | a | 300 | UG/KG | h,i |
| 1,1-Dichloroethene | 5.9E+02 | 1.2E+00 | 2.3E+03 | 1.80E-02 | 6.50E+01 | NDA | 0.044 | UG/L | | 30 | UG/KG | h |
| 2,4-Dichlorophenol | 8.9E-02 | 1.4E+00 | 4.5E+03 | 6.66E-06 | 8.71E+02 | NDA | 11 | UG/L | a | 50 | UG/KG | a,b |
| Dieldrin | 1.8E-07 | 1.8E+00 | 2.0E-01 | 2.00E-05 | 1.34E+04 | 0.0019 | 0.0042 | UG/L | | 1 | UG/KG | |
| Diethylphthalate | 2.0E-03 | 1.1E+00 | 9.0E+02 | 8.46E-07 | 6.92E+01 | NDA | 2900 | UG/L | a | 11000 | UG/KG | a,b |
| 7,12-Dimethybenz(a)anthracene | NDA | NDA | NDA | NDA | NDA | NDA | NDA | | | 700 | UG/KG | q |
| 2,4-Dimethylphenol | 9.8E-02 | 9.7E-01 | 6.2E+03 | 6.55E-06 | 1.18E+02 | NDA | 73 | UG/L | a | 300 | UG/KG | a,b |
| 2,4-Dinitrotoluene | 5.1E-03 | 1.4E+00 | 2.7E+02 | 8.67E-07 | 6.17E+01 | NDA | 7.3 | UG/L | a | 20 | UG/KG | a,b |
| Di-n-octylphthalate | 1.4E-03 | 9.8E-01 | 3.0E+00 | 1.41E-12 | 9.77E+08 | NDA | 73 | UG/L | a | 1E+08 | UG/KG | a,b |
| Dioxin (TCDD TEQ) | NDA | NDA | NDA | NDA | 3.30E+06 | NDA | 0.5 | PG/L | | 280 | PG/G | s |
| Diphenylamine | NDA | NDA | NDA | NDA | NDA | NDA | 91 | UG/L | a | NDA | | |
| Endosulfan I | 1.0E-05 | 1.7E+00 | 5.3E-01 | 1.01E-04 | 2.04E+03 | 0.0087 | 22 | UG/L | j | 400 | UG/KG | a,b,j |
| Endosulfan II | 1.0E-05 | 1.7E+00 | 2.8E-01 | 1.91E-05 | 2.34E+03 | 0.0087 | 22 | UG/L | j | 400 | UG/KG | a,b,j |
| Endosulfan sulfate | NDA | NDA | 1.2E-01 | NDA | 2.34E+03 | NDA | 22 | UG/L | j | 400 | UG/KG | a,b,j |
| Endrin | 7.0E-07 | 1.7E+00 | 2.3E-01 | 5.00E-07 | 8.32E+03 | 0.0023 | 1.1 | UG/L | a | 400 | UG/KG | h |
| Endrin aldehyde | 2.0E-07 | NDA | 2.6E-01 | 3.86E-07 | 2.69E+04 | NDA | 1.1 | UG/L | k | 400 | UG/KG | k |
| Ethylbenzene | 7.1E+00 | 8.7E-01 | 1.5E+02 | 6.60E-03 | 1.87E+02 | NDA | 130 | UG/L | a | 5000 | UG/KG | h |
| bis(2-Ethylhexyl)phthalate (BEHP | 2.0E-07 | 9.9E-01 | 3.0E-01 | 1.10E-05 | 1.00E+05 | NDA | 4.8 | UG/L | a | 11000 | UG/KG | a,b |
| Fluoranthene | 5.0E-06 | 1.3E+00 | 2.4E-01 | 1.69E-02 | 4.17E+04 | NDA | 150 | UG/L | a | 98000 | UG/KG | a,b |
| Fluorene | 7.0E-03 | 1.2E+00 | 1.7E+00 | 2.10E-04 | 5.01E+03 | NDA | 150 | UG/L | a | 16000 | UG/KG | a,b |
| Heptachlor | 3.0E-04 | 1.7E+00 | 1.8E-01 | 2.30E-03 | 2.69E+04 | 0.0036 | 0.0023 | UG/L | | 60 | UG/KG | h |
| Heptachlor epoxide | 2.6E-06 | NDA | 3.5E-01 | 3.20E-05 | 2.09E+04 | 0.0036 | 0.0012 | UG/L | | 30 | UG/KG | h |
| Hexachlorobenzene | 1.1E-05 | 1.6E+00 | 6.0E-03 | 1.70E-03 | 3.89E+03 | NDA | 0.0066 | UG/L | | 800 | UG/KG | h |
| Hexachlorobutadiene | 1.5E-01 | 1.6E+00 | 3.2E+00 | 1.03E-02 | 4.68E+03 | NDA | 0.14 | UG/L | | 100 | UG/KG | h |
| Hexachlorocyclopentadiene | 8.1E-02 | 1.7E+00 | 1.1E+00 | 1.60E-02 | 4.27E+03 | NDA | 0.015 | UG/L | a | 10000 | UG/KG | h |
| Hexachloroethane | 2.1E-01 | NDA | 5.0E+01 | 2.80E-03 | 3.10E-01 | NDA | 0.61 | UG/L | a | 200 | UG/KG | |
| Isodrin | NDA | NDA | NDA | NDA | NDA | NDA | NDA | | | NDA | | |
| Kepone | 3.0E-07 | NDA | 7.6E+00 | 2.50E-08 | 2.45E+03 | NDA | 0.0037 | UG/L | | NDA | | |
| Lead | NA | NA | NA | NA | NA | 8.5 | 15 | UG/L | o | 118 | MG/KG | d |
| Manganese | NA | NA | NA | NA | NA | NDA | 3391 | UG/L | d | 1412 | MG/KG | d |
| Mercury | NA | NA | NA | NA | NA | 0.025 | 1.1 | UG/L | a | 3 | MG/KG | h |
| Methoxychlor | 1.4E-06 | 1.4E+00 | 4.0E-02 | 1.58E-05 | 7.94E+04 | NDA | 18 | UG/L | a | 62000 | UG/KG | h |
| Methyl parathion | 9.6E-06 | NDA | 5.0E+01 | 1.00E-07 | 6.34E+01 | NDA | 0.91 | UG/L | a | 4.1 | UG/KG | a,b |
| 4-Methyl-2-Pentanone (MIBK) | 1.5E+01 | 8.0E-01 | 1.7E+04 | 1.49E-05 | 6.17E+00 | NDA | 290 | UG/L | a | 910 | UG/KG | n |
| Methylene chloride | 3.5E+02 | 1.3E+00 | 2.0E+04 | 2.00E-03 | 2.30E+01 | NDA | 4.1 | UG/L | | 10 | UG/KG | |
| 2-Methylnaphthalene | NDA | 1.0E+00 | 2.5E+01 | NDA | 8.51E+03 | NDA | 150 | UG/L | l | 3000 | UG/KG | l |
| 2-Methylphenol | 2.4E-01 | 1.0E+00 | 2.5E+04 | 1.23E-06 | 2.19E+01 | NDA | 180 | UG/L | a | 600 | UG/KG | a,b |
| 4-Methylphenol | 4.0E-02 | 1.0E+00 | 2.3E+04 | 7.92E-07 | 4.90E+01 | NDA | 18 | UG/L | a | 600 | UG/KG | m |
| Naphthalene | 5.4E-02 | 1.1E+00 | 3.0E+01 | 4.60E-04 | 7.92E+02 | NDA | 150 | UG/L | a | 3000 | UG/KG | a,b |
| Nickel | NA | NA | NA | NA | NA | 8.3 | 73 | UG/L | a | 33.38 | MG/KG | d |
| 4-Nitrophenol | 1.0E-04 | 1.5E+00 | 1.3E+04 | 3.00E-05 | 2.14E+02 | NDA | 230 | UG/L | a | 1670 | UG/KG | n |
| N-Nitroso-di-n-propylamine | 4.0E-01 | 9.2E-01 | 9.9E+03 | 6.92E-06 | 1.02E+01 | NDA | 0.0096 | UG/L | | 0.02 | UG/KG | |
| N-Nitrosodiphenylamine | NDA | NDA | NDA | NDA | NDA | NDA | 14 | UG/L | | 200 | UG/KG | |
| Parathion | 9.7E-06 | NDA | 6.5E+00 | 5.65E-07 | 6.61E+02 | NDA | 22 | UG/L | a | 390 | UG/KG | a,b |
| Pentachlorophenol | 1.1E-04 | 2.0E+00 | 2.0E+01 | 2.10E-06 | 4.09E+02 | 7.9 | 0.56 | UG/L | | 200 | UG/KG | |
| Phenanthrene | 6.8E-04 | 1.2E+00 | 1.0E+00 | 3.90E-05 | 2.29E+04 | NDA | 150 | UG/L | f | 98000 | UG/KG | f |
| Phenol | 2.0E-01 | 1.1E+00 | 8.2E+04 | 2.70E-07 | 2.69E+01 | NDA | 2200 | UG/L | a | 4900 | UG/KG | a,b |
| Pyrene | 2.5E-06 | 1.3E+00 | 1.4E-01 | 1.09E-05 | 6.46E+04 | NDA | 110 | UG/L | a | 140000 | UG/KG | a,b |

1500mg/Kg

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Constituents Detected in Soil and Groundwater
NAVBASE-Charleston, Zone H

| Parameter | Vapor Pressure (mm Hg) | Density (g/cm3) | Solubilit (mg/L) | Henry's Law Constant (atm-m3/ mole) | Organic Carbon Water Part. Coeff. (L/kg) | Salt Water Chronic WQC ! (ug/L) | Tap Water RBC or UTL * | Water Units | | Ground Water Protection SSL or UTL ** | Soil Units | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Selenium | NA | NA | NA | NA | NA | 71 | 18 | UG/L | a | 3 | MG/KG | h | |
| Silver | NA | NA | NA | NA | NA | NDA | 18 | UG/L | a | NDA | | | |
| 2,4,5-T | 7.5E-07 | 1.4E+00 | 2.8E+02 | 8.68E-08 | 2.04E+02 | NDA | 37 | UG/L | a | 260 | UG/KG | n | |
| 2,4,5-TP (Silvex) | 5.2E-06 | NDA | 1.4E+02 | 1.31E-07 | 2.57E+03 | NDA | 29 | UG/L | a | 1580 | UG/KG | n | |
| Total Petroleum Hydrocarbons (IR | NDA | NDA | NDA | NDA | NDA | NDA | NDA | | | NDA | | | |
| Tetrachloroethene | 1.4E+01 | 1.6E+00 | 1.5E+02 | 1.53E-02 | 2.64E+02 | NDA | 1.1 | UG/L | | 40 | UG/KG | | |
| Tetrahydrofuran | 1.6E+02 | 8.9E-01 | NDA | 9.63E-03 | 1.95E+00 | NDA | NDA | | | NDA | | | |
| Thallium | NA | NA | NA | NA | NA | NDA | 7.66 | UG/L | d | 1.3 | MG/KG | d | |
| Tin | NA | NA | NA | NA | NA | NDA | 2200 | UG/L | a | NDA | | | |
| Toluene | 2.2E+01 | 8.7E-01 | 5.2E+02 | 6.70E-03 | 1.29E+02 | NDA | 75 | UG/L | a | 5000 | UG/KG | h | 1700 mg/Kg |
| Toxaphene | 3.3E-05 | 1.6E+00 | 7.4E-01 | 6.30E-02 | 1.51E+03 | 0.0002 | 0.061 | UG/L | | 40 | UG/KG | h | |
| 1,2,4-Trichlorobenzene | 4.0E-01 | 1.5E+00 | 3.0E+01 | 2.32E-03 | 1.56E+03 | NDA | 19 | UG/L | a | 2000 | UG/KG | h | |
| 1,1,1-Trichloroethane | 1.0E+02 | 1.3E+00 | 1.6E+03 | 1.62E-02 | 1.28E+02 | NDA | 130 | UG/L | a | 900 | UG/KG | h | |
| Trichloroethene | 5.8E+01 | 1.5E+00 | 1.1E+03 | 9.10E-03 | 8.70E+01 | NDA | 1.6 | UG/L | | 20 | UG/KG | h | |
| Trichlorofluoromethane | 6.9E+02 | 1.5E+00 | 1.1E+03 | 1.10E-01 | 1.59E+02 | NDA | 130 | UG/L | a | 1300 | UG/KG | a,b | |
| 2,4,5-Trichlorophenol | NDA | 1.7E+00 | NDA | NDA | NDA | NDA | 370 | UG/L | a | 12000 | UG/KG | a,b | |
| 2,4,6-Trichlorophenol | 1.7E-02 | 1.5E+00 | 8.0E+02 | 9.07E-08 | 1.07E+03 | NDA | 6.1 | UG/L | | 50 | UG/KG | | |
| 1,2,3-Trichloropropane | 3.1E+00 | 1.4E+00 | 1.8E+03 | 3.44E-04 | 7.24E+01 | NDA | 0.0015 | UG/L | | 0.006 | UG/KG | | |
| Vanadium | NA | NA | NA | NA | NA | NDA | 26 | UG/L | a | 131.6 | MG/KG | d | |
| Vinyl chloride | 2.6E+03 | 9.1E-01 | 1.1E+03 | 1.22E+00 | 1.10E+01 | NDA | 0.019 | UG/L | | 10 | UG/KG | h | |
| Xylene (total) | 8.7E+00 | 8.8E-01 | 2.0E+02 | 7.10E-03 | 2.34E+02 | NDA | 1200 | UG/L | a | 74000 | UG/KG | h | 44000 mg/Kg |
| Zinc | NA | NA | NA | NA | NA | 86 | 1100 | UG/L | a | 4200 | MG/KG | | |

* - Ground water screening concentration which is the greater of:
1. Tap water risk-based concentration as presented in EPA Region III tables (1/31/95)
2. Background upper tolerance limit for shallow groundwater; NAVBASE Charleston - Zone H

** - Soil screening concentration which is the greater of:
1. Soil screening levels which governs soil to water transfer as presented in EPA Region III risk-based concentration tables (1/31/95)
2. Background upper tolerance limit for surface or subsurface soil; NAVBASE Charleston - Zone H

(Risk based screening concentrations assume a target risk of 1E-06, a target hazard index of 0.1, and a dilution attenuation factor of 10)

! - Salt Water Chronic Water Quality Criteria as provided in EPA (1993) Quality Criteria for Water
NA - Not applicable
NDA - No data available
a - based on target hazard index of 0.1
b - target soil leachate concentration based on the tap water RBC
c - acenaphtene used as a surrogate
d - background upper tolerance limit
e - gamma-BHC used as a surrogate
f - fluoranthene used as a surrogate
g - 1,2-dichlorobenzene used as a surrogate
h - target leachate soil concentration based on a MCL
i - value for trans - 1,2-dichloroethene
j - endosulfan used as a surrogate
k - endrin used as a surrogate
l- naphthalene used as a surrogate
m - 2-methylphenol used as a surrogate
n - Calculated using Soil Screening Guidance (EPA 12/94) using contaminant specific values
o - Treatment technique action level for water
p - based on the MCL for total trihalomethanes of 0.08 mg/L
q - benzo(a)anthracene used as a surrogate
r - estimated to be greater than 1000 ug/kg based on structural similarities to 2,4-D
s - Dioxin (TCDD TEQ) soil screening value based on the tap water RBC and site specific soil parameters

Table 5.3.1
Chemicals Detected in Soil
Comparison to Groundwater Protection SSL or Background UTL
NAVBASE-Charleston, Zone H, SWMUs 9,19,20,121 and AOCs 649,650,654

| Parameter | Units | SWMU 19 Surface Soil | SWMU 19 Subsurface Soil | SWMU 20 Surface Soil | SWMU 20 Subsurface Soil | SWMU 121 Surface Soil | SWMU 121 Subsurface Soil | AOC 649,650,651 Surface Soil | AOC 649,650,651 Subsurface Soil | AOC 654 Surface Soil | AOC 654 Subsurface Soil | Ground-Water Protection SSL | Detected in Ground-water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | ug/kg | 217 | 360 | 210 | ND | 130 | ND | ND | ND | ND | ND | 20000 | I,II |
| Acenaphthylene | ug/kg | ND | 130 | ND | ND | 590 | ND | ND | ND | ND | ND | 20000 | |
| Acetone | ug/kg | 33 | 47 | ND | ND | 193.5 | ND | 25.2 | ND | 4000 | 1700 * | 800 | I,II |
| Acrylonitrile | ug/kg | ND | ND | ND | ND | 34.5 | ND * | 36.9 | ND * | ND | ND | 0.04 | |
| Aluminum | mg/kg | 11900 | 8210 | ND | ND | 16000 | 15500 | 10900 | 3280 | 6890 | 6530 | 46180 | I,II |
| Anthracene | ug/kg | 357 | 670 | 450 | 170 | 610 | ND | 250 | ND | ND | 130 | 430000 | |
| Antimony | mg/kg | 726 | 1.4 | ND | ND | 7.3 | ND | 1.6 | ND | ND | ND | NDA | I (x) |
| Aroclor-1248 | ug/kg | ND | ND | ND | ND | 160 | 37 | 52 | 30 | ND | ND | 8200 | |
| Aroclor-1254 | ug/kg | 2300 | ND | ND | ND | 4300 | 82 | 407 | 30 | ND | ND | 8200 | |
| Aroclor-1260 | ug/kg | 560 | ND | ND | ND | 1100 | 88 | ND | ND | ND | ND | 8200 | |
| Arsenic | mg/kg | 22.1 | 8.3 | ND | ND | 18.7 | 10.7 | 9.5 | 3 | 7.7 | 18.4 | 35.52 | I,II (x) |
| delta-BHC | ug/kg | ND | ND | ND | ND | ND | ND | ND | ND | 1.2 | ND | 6 | |
| Barium | mg/kg | 128 | 64.1 * | ND | ND | 530 | 89.7 * | 57.9 | ND * | 38.7 | ND | 43.8 | I,II (x) |
| Benzene | ug/kg | 64 | ND * | ND | ND | ND | ND | ND | ND | ND | ND | 20 | I,II (x) |
| Benzo(g,h,i)perylene | ug/kg | 215 | 600 | 250 | ND | 780 | 93 | 1100 | ND | ND | ND | 98000 | |
| Benzo(a)pyrene | ug/kg | 604 | 1400 | 820 | 430 | 1700 | 200 | 2000 | ND | ND | ND | 4000 | |
| Benzo(a)anthracene | ug/kg | 811 | 1700 * | 950 | 580 * | 1900 | 160 * | 1900 | ND * | ND | 140 | 700 | |
| Benzo(b)fluoranthene | ug/kg | 935 | 1700 | 1400 | 680 | 2700 | 200 | 4000 | ND | 110 | ND | 4000 | |
| Benzo(k)fluoranthene | ug/kg | 712 | 1200 | 660 | 400 | 2200 | 230 | 130 | ND | ND | 140 | 4000 | |
| Chrysene | ug/kg | 755 | 1600 * | 940 | 610 | 2000 | 170 * | 1900 | ND * | ND | ND | 1000 | |
| Dibenzo(a,h)anthracene | ug/kg | ND | 250 | 100 | ND | 280 | ND | 390 | ND | ND | ND | 11000 | |
| Indeno(1,2,3-cd)pyrene | ug/kg | 240 | 590 | 260 | ND | 750 | ND | 910 | ND | ND | ND | 35000 | |
| Benzoic acid | ug/kg | ND | ND | ND | ND | ND | ND | 269 | ND | ND | ND | 28000 | I |
| Beryllium | mg/kg | 3 | 0.61 | ND | ND | 14.6 | 2.6 | 1.1 | 0.2 | 0.49 | 0.59 | 180 | II (x) |
| 2-Butanone (MEK) | ug/kg | ND | ND | ND | ND | 37.1 | ND | ND | ND | ND | ND | 570 | I |
| Butylbenzylphthalate | ug/kg | 2300 | 150 | 190 | 430 | 2600 | ND | 1540 | ND | ND | ND | 6800 | II |
| Cadmium | mg/kg | 1.8 | 0.64 | ND | ND | 2.5 | ND | 0.39 | ND | 0.97 | 1.5 | 6 | I,II |
| Carbon disulfide | ug/kg | 9.9 | ND | ND | ND | ND | ND | 4.8 | ND | ND | 11 | 1400 | I,II (x) |
| alpha-Chlordane | ug/kg | 9.35 | ND | ND | ND | ND | ND | 11.6 | 2 | 69.1 | ND | 2000 | |
| gamma-Chlordane | ug/kg | 4 | ND | ND | ND | 4 | ND | 6 | ND | 41 | ND | 2000 | |
| Chlorobenzene | ug/kg | 64 | ND * | ND | ND | ND | ND | 5.18 | ND | ND | ND | 60 | I,II (x) |
| Chloroform | ug/kg | 1.5 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 300 | |
| Chromium | mg/kg | 49.2 | 20.7 | ND | ND | 210 | 50.8 * | 24.4 | 12.3 | 53.3 | 70.7 | 85.65 | I,II (x) |
| Cobalt | mg/kg | 43.3 | 5.5 * | ND | ND | 97.2 | 15.9 * | 9.5 | 1.5 | 3.1 | 4.3 | 14.88 | I,II |
| Copper | mg/kg | 3040 | 309 * | ND | ND | 4060 | 680 * | 357 | 24.6 * | 57.1 | 13.1 * | 31.62 | I,II (x) |
| Cyanide | mg/kg | ND | ND | ND | ND | 9.9 | ND | ND | ND | 2 | 1 | NDA | |
| 2,4-D | ug/kg | 41.8 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1700 | |
| 4,4'-DDD | ug/kg | 6 | 10 | ND | ND | ND | ND | 8 | ND | ND | ND | 700 | II |
| 4,4'-DDE | ug/kg | 5 | 12 | ND | ND | 20.5 | ND | 10.2 | 3 | 6.15 | ND | 500 | II |
| 4,4'-DDT | ug/kg | 16 | ND | ND | ND | 14 | ND | 7 | ND | 10 | ND | 1000 | I |
| Dibenzofuran | ug/kg | 124 | 200 | 220 | ND | 89 | ND | 56.5 | ND | ND | ND | 12000 | I,II |
| Diethylphthalate | ug/kg | ND | ND | ND | ND | 85.2 | ND | ND | ND | ND | ND | 11000 | I |
| Di-n-butylphthalate | ug/kg | 1100 | ND | ND | ND | ND | ND | 222 | ND | ND | ND | 12000 | I,II |

BEQ specific levels

VOC ESTIMATES

for bioremedition of petroleum contaminated soil

| | B cuyd / site x | C sites x | 27 cuft / cuyd x | E lbs / cuft x | F ppm x | million / $10^6$ part x | H % voc / period = | emissions subtotal | (lbs/month) total |
|---|---|---|---|---|---|---|---|---|---|
| diesel | 20 | 24 | 27 | 115 | 1600 | 1E-06 | 0.033 | **79** | |
| gasoline | | 0 | | | | | | **0** | |
| | | | | | | | | | **79** |

B = average cubic yards per site

C = number of sites in 3 month period

E = soil density

F = average TPH (based on actual samples from several sites)

H = total % of TPH emitted as VOCs divided by a period of 3 months

It is assumed that input rate of the soil is such that when combined with the non linear decay rate, equal monthly emissions occur throughtout the period. Also, conservatively assumes no vocs emitted during digging/transport.

diesel: 6-7% total voc - assume .1 divided by 3 months

gas: 85-90% total voc - assume .9 divided by 3 months

% total voc obtained from Jeff O'Conner, PE at Southwest Division, Naval Facilities Engineering Command in San Diego, Calif on 4/8/96

Response to DHEC Comments (dtd 10/17) on Bioremediation

comment #1

. . *In consideration of the above* (Environmental Regs*), appropriate assessments of the excavation should be conducted to determine the extent and severity, if any, of potential residual contamination. The document as submitted does not provide procedures and methodologies for the assessment(s) noted above, either directly or through reference. It seems appropriate to consider the condition of the tank excavation bottom (i.e., impacted or no impacts) in determining the final disposition for excavated materials.*

All UST removals will be performed in accordance with South Carolina Department of Health and Environmental Control (DHEC) regulation R.61-92, Part 280 (Underground Storage Tank Control Regulations). The method for tank removal and assessment reporting will be as outlined in SC DHEC's "Underground Storage Tank Assessment Guidelines for Permanent Closure, Change-In-Owner and Change-In-Service," dated June, 1995.

comment #2

*Consistent with the above* (the first point), *the document fails to provide a decision matrix for determining the extent of soils excavation required to justify closure of each tank pit under the USTCR or PCA, as appropriate.*

Currently, the only soil removed from each UST site is the amount needed to remove the tank. With the initiation of the soil corrective action plan , UST excavations will be evaluated for further removal of petroleum contaminated soil. Where no structural or physical obstacles limit the size of the excavation, the pit will be examined for evidence of petroleum releases based on sight, smell, or condition of the tank. Field sampling using an Organic Vapor Analyzer (OVA) for headspace analysis will determine if further soil needs to be removed from the excavation. OVA readings of greater than 250 parts per million will result in further excavation of the contaminated soil. Where feasible, the pit will be left open until laboratory analysis are obtained.

comment #3

*The proposed sampling list for chemicals of concern should incorporate all polyaromatic hydrocarbons (PAH) identified in the Drinking Water Regulations and Health Advisories, as published by the Environmental Protection Agency.*

An expanded list of PAH's and other chemicals of concerns have already had Soil Screening Levels (SSL's) established for the Charleston Naval Complex as described in our letter ser: 252 of 12/4/96. The referenced SSL information will be incorporated into the SCAP as addressed in your responce dated 15 Jan.

comment #4

*The document fails to provide for appropriate reporting and/or documentation technically justifying a chosen course of action for each site.*

The method for tank removal and assessment reporting will be as outlined in SC DHEC's "Underground Storage Tank Assessment Guidelines for Permanent Closure, Change-In-Owner and Change-In-Service," dated June, 1995.

comment #5

*The document fails to provide for appropriate sampling/analysis and disposal of collected leachate, if any, generated during remedial endeavors.*

Any collected leachate will be immediately returned to the soil being treated, based on moisture level, or temporarily stored and then returned. No sampling/analysis is considered necessary. In the event the stored leachate becomes excessive, sampling for compliance with National Pollutant Discharge Elimination System(NPDES) requirements will be performed. If the sample is in compliance, the leachate will be discharged to the North Charleston Publicly Owned Treatment Works. Otherwise, the leachate will be evaluated for alternate disposition.

comment #6

*The facility must provide an adequate demonstration that the volatile organic compound (VOC) emission rate will not exceed one thousand (1000) pounds per month.*

An estimate of the expected VOC emission rate will be added to the SCAP as an attachment and is considered an adequate demonstration that the rate will not exceed one thousand pounds per month.

South Carolina
DHEC
Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201-1708



pl

Mr. Earl R. Dearhart
Director, Supervisor of Shipbuilding, Conversion and Repair
USN Portsmouth, Virginia, Detachment Environmental Charleston
1899 North Hobson Avenue, Building 30
North Charleston, SC 29405-2106

Re: Response to Comments, Proposed Soils Corrective Action Plan (SCAP) for Petroleum Contaminated Soils dated December 4, 1996
Charleston Naval Complex (Site Identification # 15405- General)
Charleston Naval Base, SC
Charleston County

Date: January 15, 1997

Dear Mr. Dearhart:

The author has completed technical review of the referenced document. As submitted, the information addresses previous Department concerns regarding environmental sampling for chemicals of concern at potential petroleum release sites. As such, the author is amenable to having the referenced information incorporated into the Soils Corrective Action Plan.

Should you have any questions, please contact me at (803) 734-5328.

Sincerely,

Paul L. Bristol

Paul L. Bristol, Hydrogeologist
Groundwater Assessment and Development Section
Bureau of Water

cc: Trident District EQC

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Lo 1.15.97

**DEPARTMENT OF THE NAVY**
SUPERVISOR OF SHIPBUILDING, CONVERSION AND REPAIR, USN
PORTSMOUTH, VIRGINIA, DETACHMENT ENVIRONMENTAL CHARLESTON
1899 NORTH HOBSON AVENUE, BUILDING 30
NORTH CHARLESTON, SOUTH CAROLINA 29405-2106

#15405
Gen corresp

IN REPLY REFER TO:

Ser: 252
December 4, 1996

South Carolina Department of Health
and Environmental Control
Bureau of Water, Groundwater
Assessment and Development Section
2600 Bull Street
Columbia South Carolina 29201-1708

RECEIVED
DEC 06 1996
Groundwater Assessment
and Development Section

Re: Comments on the Proposed Soil Corrective Action Plan (SCAP) for Petroleum Contaminated Soil at the Charleston Naval Complex, dated October 17, 1996.

Dear Mr. Bristol:

We have reviewed your comments on the proposed Soil Corrective Action Plan (SCAP) for petroleum contaminated soil at the Charleston Naval Complex. We have added further references and information which should answer any of your initial concerns. One area that may need clarification involves your third bullet comment which states:

> "The proposed sampling list for chemicals of concern should incorporate all polyaromatic hydrocarbons (PAH) identified in the Drinking Water Regulations and Health Advisories, as published by the Environmental Protection Agency."

As you noted, the proposed SCAP referenced only the six PAH's from the SCDHEC, Risk-Based Corrective Action for Petroleum Releases, along with their associated risk based screening levels (RBSL) from the look-up tables. In addressing the remaining PAH's, we contacted members of the Installation Restoration (IR) team at Southern Division Naval Facilities Engineering and Command (SOUTHDIV) in an effort to establish either RBSL's or soil screening levels (SSLs) for the remaining PAH's.

When we met with members of the IR team, we found that SSL's had already been established for an expanded list of PAH's. The PAH's along with their SSL's are outlined in the Resource Conservation and Recovery Act (RCRA) Facility Investigation (RFI) documents. The RFI tables of chemicals and SSL's are based on the Environmental Protection Agency Region III Risk-Based Concentration Table.

The RFI Groundwater Protection SSL Tables for NAVBASE Charleston, Zone H is enclosed for your consideration. Our intent is to use these SSL's as a pass/fail criteria for excavated soil. Further risk assessment and/or action will be performed for chemicals with concentrations above the SSL's.

If the use of the SSL's for PAH's from the enclosed tables meets with your approval, it will be incorporated in the SCAP. The revised SCAP will then be resubmitted for your review.

Sincerely,

Earl R. Dearhart
Director, Supervisor of Shipbuilding, Conversion and Repair,
USN, Portsmouth, Va, Environmental Detachment Charleston, SC

Encl: RFI Groundwater Protection SSL Tables for NAVBASE Charleston, Zone H

cc: Paul Bergstrand, SCDHEC, Bureau of Solid and Hazardous Waste
Johnny Tapia, SCDHEC, Bureau of Solid and Hazardous Waste
Gabriel Magwood, SOUTHDIV
Tony Hunt, SOUTHDIV

Table 5.2.1
Fate and Transport Properties and Screening Levels for
Constituents Detected in Soil and Groundwater
NAVBASE-Charleston, Zone H

| Parameter | Vapor Pressure (mm Hg) | Density (g/cm3) | Solubilit (mg/L) | Henry's Law Constant (atm-m3/ mole) | Organic Carbon Water Part. Coeff. (L/kg) | Salt Water Chronic WQC ! (ug/L) | Tap Water RBC or UTL * | Water Units | | Ground Water Protection SSL or UTL ** | Soil Units | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Acenaphthene | 1.6E-03 | 1.0E+00 | 3.5E+00 | 1.70E-04 | 1.78E+01 | NDA | 220 | UG/L | a | 20000 | UG/KG | a,b |
| Acenaphthylene | 2.9E-02 | 9.0E-01 | 3.9E+00 | 2.00E-04 | 3.97E+01 | NDA | 220 | UG/L | c | 20000 | UG/KG | c |
| Acetone | 2.7E+02 | 7.9E-01 | 1.0E+06 | 3.97E-05 | 3.70E-01 | NDA | 370 | UG/L | a | 800 | UG/KG | a,b |
| Acetonitrile | 8.8E+01 | 7.9E-01 | NDA | 2.93E-05 | 4.80E-01 | NDA | 22 | UG/L | a | 70 | UG/KG | n |
| Acrylonitrile | 1.0E+02 | 8.0E-01 | 7.9E+04 | 1.10E-04 | 7.40E-02 | NDA | 0.12 | UG/L | | 0.04 | UG/KG | n |
| Aldrin | 6.0E-06 | 1.7E+00 | 2.7E-02 | 2.67E-05 | 4.07E+02 | NDA | 0.004 | UG/L | | 5 | UG/KG | |
| Aluminum | NA | NA | NA | NA | NA | NDA | 3700 | UG/L | a | 46180 | MG/KG | d |
| Ammonia | NDA | NDA | NDA | NDA | NDA | NDA | 34 | MG/L | | NDA | | |
| Anthracene | 2.0E-04 | 1.3E+00 | 4.5E-02 | 6.50E-05 | 1.86E+04 | NDA | 1100 | UG/L | a | 430000 | UG/KG | a,b |
| Antimony | NA | NA | NA | NA | NA | NDA | 1.5 | UG/L | a | NDA | | |
| Aroclor-1248 | 4.9E-04 | 1.4E+00 | 5.4E-02 | 3.50E-03 | 4.37E+05 | 0.03 | 0.0087 | UG/L | | 8200 | UG/KG | |
| Aroclor-1254 | 7.7E-05 | 1.5E+00 | 5.0E-02 | 2.70E-03 | 4.31E+05 | 0.03 | 0.0087 | UG/L | | 8200 | UG/KG | |
| Aroclor-1260 | 4.1E-05 | 1.6E+00 | 8.0E-02 | 7.10E-03 | 8.22E+05 | 0.03 | 0.0087 | UG/L | | 8200 | UG/KG | |
| Arsenic | NA | NA | NA | NA | NA | 36 | 27.99 | UG/L | d | 35.52 | MG/KG | d |
| Azobenzene | NDA | NDA | NDA | NDA | NDA | NDA | 0.61 | UG/L | | NDA | | |
| beta-BHC | 2.8E-07 | 1.9E+00 | 2.4E-01 | 2.30E-07 | 2.48E+03 | NDA | 0.037 | UG/L | | 2 | UG/KG | |
| alpha-BHC | 2.5E-05 | 1.9E+00 | 1.6E+00 | 5.30E-06 | 1.82E+03 | NDA | 0.011 | UG/L | | 0.4 | UG/KG | |
| delta-BHC | 1.7E-05 | 1.9E+00 | 3.1E-01 | 2.50E-07 | 1.50E+03 | NDA | 0.052 | UG/L | e | 6 | UG/KG | e |
| gamma-BHC (Lindane) | 6.7E-05 | 1.6E+00 | 7.5E+00 | 3.25E-06 | 1.21E+03 | NDA | 0.052 | UG/L | | 6 | UG/KG | |
| Barium | NA | NA | NA | NA | NA | NDA | 323 | UG/L | d | 43.8 | MG/KG | d |
| Benzene | 9.5E+01 | 8.7E-01 | 1.8E+03 | 5.40E-03 | 5.00E+01 | NDA | 0.36 | UG/L | | 20 | UG/KG | |
| Benzidine | 5.0E-04 | 1.3E+00 | 4.0E+02 | 3.88E-11 | 3.98E+01 | NDA | 0.00029 | UG/L | | 0.0011 | UG/KG | |
| Benzo(g,h,i)perylene | 1.0E-10 | NDA | 2.6E-04 | 1.40E-07 | 7.76E+06 | NDA | 150 | UG/L | f | 98000 | UG/KG | f |
| Benzo(a)pyrene Equivalents | 5.6E-09 | 1.4E+00 | 3.9E-03 | 2.40E-06 | 1.77E+06 | NDA | 0.0092 | UG/L | | 4000 | UG/KG | |
| Benzoic acid | 1.0E+00 | 1.3E+00 | 3.4E+03 | 7.02E-07 | 1.82E+02 | NDA | 15000 | UG/L | a | 28000 | UG/KG | a,b |
| Beryllium | NA | NA | NA | NA | NA | NDA | 0.016 | UG/L | | 180 | MG/KG | |
| Bromomethane | 1.6E+03 | 1.7E+00 | 1.3E+04 | 2.00E-01 | 8.32E+01 | NDA | 0.87 | UG/L | a | 10 | UG/KG | a,b |
| 4-Bromophenyl-phenylether | 1.5E-03 | 1.4E+00 | NDA | 1.00E-04 | 8.71E+04 | NDA | 210 | UG/L | a | 36600 | UG/KG | |
| 2-Butanone (MEK) | 7.8E+01 | 8.1E-01 | 2.7E+05 | 4.66E-05 | 1.23E+00 | NDA | 190 | UG/L | a | 570 | UG/KG | n |
| Butylbenzylphthalate | 8.6E-06 | 1.1E+00 | 2.8E+00 | 1.30E-06 | 1.51E+02 | NDA | 730 | UG/L | a | 6800 | UG/KG | a,b |
| Cadmium | NA | NA | NA | NA | NA | 9.3 | 1.8 | UG/L | a | 6 | MG/KG | h |
| Carbon disulfide | 3.0E+02 | 1.3E+00 | 2.1E+03 | 1.33E-02 | 2.95E+02 | NDA | 2.1 | UG/L | a | 1400 | UG/KG | a,b |
| alpha-Chlordane | 1.0E-05 | 1.6E+00 | 5.6E-02 | 4.80E-05 | 4.95E+04 | 0.004 | 0.052 | UG/L | | 2000 | UG/KG | |
| gamma-Chlordane | 1.0E-05 | 1.6E+00 | 5.6E-02 | 4.80E-05 | 4.95E+04 | NDA | 0.052 | UG/L | | 2000 | UG/KG | |
| Chlorobenzene | 1.0E+01 | 1.1E+00 | 4.9E+02 | 3.93E-03 | 1.73E+02 | NDA | 3.9 | UG/L | a | 60 | UG/KG | a,b |
| Chlorobenzilate | 2.2E-06 | NDA | 1.3E+01 | 7.24E-08 | 1.07E+03 | NDA | 0.25 | UG/L | | 0.6 | UG/KG | n |
| Chloroethane | 1.0E+03 | 9.0E-01 | 5.7E+03 | 1.00E-02 | 3.47E+00 | NDA | 860 | UG/L | a | 3300 | UG/KG | a,b |
| bis(2-Chloroethyl)ether | 1.2E+00 | 1.2E+00 | 1.0E+04 | 1.30E-05 | 1.41E+01 | NDA | 0.0092 | UG/L | | 0.3 | UG/KG | |
| Chloroform | 1.6E+02 | 1.5E+00 | 8.0E+03 | 3.23E-03 | 4.60E+01 | NDA | 0.15 | UG/L | | 300 | UG/KG | |
| Chloromethane | 3.8E+03 | 9.2E-01 | 7.3E+03 | 8.82E-03 | 2.51E+01 | NDA | 1.4 | UG/L | | 6.6 | UG/KG | |
| 4-Chloro-3-methylphenol | 5.0E-02 | NDA | 3.9E+03 | 1.78E-06 | 7.76E+02 | NDA | NDA | | | NDA | | |
| 2-Chlorophenol | 1.4E+00 | 1.3E+00 | 2.8E+04 | 8.28E-06 | 3.63E+02 | NDA | 18 | UG/L | a | 200 | UG/KG | a,b |
| Chromium | NA | NA | NA | NA | NA | 50 | 18 | UG/L | a | 85.65 | MG/KG | d |
| Cobalt | NA | NA | NA | NA | NA | NDA | 220 | UG/L | a | 14.88 | MG/KG | d |
| Copper | NA | NA | NA | NA | NA | 2.9 | 140 | UG/L | a | 31.62 | MG/KG | d |
| Cyanide | NA | NA | NA | NA | NA | 1 | 75 | UG/L | a | NDA | | |
| 2,4-D | 1.1E-02 | 1.4E+00 | 6.8E+02 | 1.37E-10 | 1.58E+00 | NDA | 6.1 | UG/L | a | 1700 | UG/KG | h |
| 2,4-DB | NDA | NDA | NDA | NDA | NDA | NDA | 29 | UG/L | a | 1000 | UG/KG | r |
| 4,4'-DDD | 1.0E-06 | 1.5E+00 | 2.0E-02 | 2.16E-05 | 4.37E+04 | NDA | 0.28 | UG/L | | 700 | UG/KG | |
| 4,4'-DDE | 6.5E-06 | | 4.0E-02 | 2.34E-05 | 2.45E+05 | NDA | 0.2 | UG/L | | 500 | UG/KG | |
| 4,4'-DDT | 1.9E-07 | 1.6E+00 | 5.0E-03 | 4.89E-05 | 3.87E+05 | 0.001 | 0.2 | UG/L | | 1000 | UG/KG | |
| DCAA | NDA | NDA | NDA | NDA | NDA | NDA | NDA | | | NDA | | |
| Dibenzofuran | NDA | 1.1E+00 | 1.0E+01 | NDA | 1.00E+04 | NDA | 15 | UG/L | a | 12000 | UG/KG | a,b |
| Dibromochloromethane | 7.6E+01 | 2.5E+00 | 4.0E+03 | 9.90E-04 | 8.32E+01 | NDA | NDA | | | 38 | UG/KG | p |

Table 5.2.1
Fate and Transport Properties and Screening Levels for
Constituents Detected in Soil and Groundwater
NAVBASE-Charleston, Zone H

| Parameter | Vapor Pressure (mm Hg) | Density (g/cm3) | Solubilit (mg/L) | Henry's Law Constant (atm-m3/ mole) | Organic Carbon Water Part. Coeff. (L/kg) | Salt Water Chronic WQC ! (ug/L) | Tap Water RBC or UTL * | Water Units | | Ground Water Protection SSL or UTL ** | Soil Units | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Di-n-butylphthalate | 1.0E-05 | 1.0E+00 | 1.3E+01 | 6.30E-05 | 1.38E+03 | NDA | 370 | UG/L | a | 12000 | UG/KG | a,b |
| 1,2-Dichlorobenzene | 1.0E+00 | 1.3E+00 | 1.0E+02 | 1.90E-03 | 1.82E+02 | NDA | 27 | UG/L | a | 600 | UG/KG | h |
| 1,4-Dichlorobenzene | 6.0E-01 | 1.2E+00 | 7.9E+01 | 3.10E-03 | 5.11E+02 | NDA | 0.44 | UG/L | | 1000 | UG/KG | h |
| 1,3-Dichlorobenzene | 2.3E+00 | 1.3E+00 | 1.2E+02 | 3.60E-03 | 1.70E+02 | NDA | 54 | UG/L | a | 600 | UG/KG | g |
| 1,2-Dichloroethane | 6.4E+01 | 1.3E+00 | 8.7E+03 | 9.80E-04 | 1.41E+01 | NDA | 0.12 | UG/L | | 10 | UG/KG | |
| 1,1-Dichloroethane | 1.8E+02 | 1.2E+00 | 5.5E+03 | 5.45E-03 | 3.40E+01 | NDA | 81 | UG/L | a | 1100 | UG/KG | |
| 1,2-Dichloroethene (total) | 3.0E+02 | NDA | 3.5E+03 | 5.00E-03 | 2.30E-02 | NDA | 5.5 | UG/L | a | 300 | UG/KG | h,i |
| 1,1-Dichloroethene | 5.9E+02 | 1.2E+00 | 2.3E+03 | 1.80E-02 | 6.50E+01 | NDA | 0.044 | UG/L | | 30 | UG/KG | h |
| 2,4-Dichlorophenol | 8.9E-02 | 1.4E+00 | 4.5E+03 | 6.66E-06 | 8.71E+02 | NDA | 11 | UG/L | a | 50 | UG/KG | a,b |
| Dieldrin | 1.8E-07 | 1.8E+00 | 2.0E-01 | 2.00E-05 | 1.34E+04 | 0.0019 | 0.0042 | UG/L | | 1 | UG/KG | |
| Diethylphthalate | 2.0E-03 | 1.1E+00 | 9.0E+02 | 8.46E-07 | 6.92E+01 | NDA | 2900 | UG/L | a | 11000 | UG/KG | a,b |
| 7,12-Dimethybenz(a)anthracene | NDA | NDA | NDA | NDA | NDA | NDA | NDA | | | 700 | UG/KG | q |
| 2,4-Dimethylphenol | 9.8E-02 | 9.7E-01 | 6.2E+03 | 6.55E-06 | 1.18E+02 | NDA | 73 | UG/L | a | 300 | UG/KG | a,b |
| 2,4-Dinitrotoluene | 5.1E-03 | 1.4E+00 | 2.7E+02 | 8.67E-07 | 6.17E+01 | NDA | 7.3 | UG/L | a | 20 | UG/KG | a,b |
| Di-n-octylphthalate | 1.4E-03 | 9.8E-01 | 3.0E+00 | 1.41E-12 | 9.77E+08 | NDA | 73 | UG/L | a | 1E+08 | UG/KG | a,b |
| Dioxin (TCDD TEQ) | NDA | NDA | NDA | NDA | 3.30E+06 | NDA | 0.5 | PG/L | | 280 | PG/G | s |
| Diphenylamine | NDA | NDA | NDA | NDA | NDA | NDA | 91 | UG/L | a | NDA | | |
| Endosulfan I | 1.0E-05 | 1.7E+00 | 5.3E-01 | 1.01E-04 | 2.04E+03 | 0.0087 | 22 | UG/L | j | 400 | UG/KG | a,b,j |
| Endosulfan II | 1.0E-05 | 1.7E+00 | 2.8E-01 | 1.91E-05 | 2.34E+03 | 0.0087 | 22 | UG/L | j | 400 | UG/KG | a,b,j |
| Endosulfan sulfate | NDA | NDA | 1.2E-01 | NDA | 2.34E+03 | NDA | 22 | UG/L | j | 400 | UG/KG | a,b,j |
| Endrin | 7.0E-07 | 1.7E+00 | 2.3E-01 | 5.00E-07 | 8.32E+03 | 0.0023 | 1.1 | UG/L | a | 400 | UG/KG | h |
| Endrin aldehyde | 2.0E-07 | NDA | 2.6E-01 | 3.86E-07 | 2.69E+04 | NDA | 1.1 | UG/L | k | 400 | UG/KG | k |
| Ethylbenzene | 7.1E+00 | 8.7E-01 | 1.5E+02 | 6.60E-03 | 1.87E+02 | NDA | 130 | UG/L | a | 5000 | UG/KG | h |
| bis(2-Ethylhexyl)phthalate (BEHP | 2.0E-07 | 9.9E-01 | 3.0E-01 | 1.10E-05 | 1.00E+05 | NDA | 4.8 | UG/L | a | 11000 | UG/KG | a,b |
| Fluoranthene | 5.0E-06 | 1.3E+00 | 2.4E-01 | 1.69E-02 | 4.17E+04 | NDA | 150 | UG/L | a | 98000 | UG/KG | a,b |
| Fluorene | 7.0E-03 | 1.2E+00 | 1.7E+00 | 2.10E-04 | 5.01E+03 | NDA | 150 | UG/L | a | 16000 | UG/KG | a,b |
| Heptachlor | 3.0E-04 | 1.7E+00 | 1.8E-01 | 2.30E-03 | 2.69E+04 | 0.0036 | 0.0023 | UG/L | | 60 | UG/KG | h |
| Heptachlor epoxide | 2.6E-06 | NDA | 3.5E-01 | 3.20E-05 | 2.09E+04 | 0.0036 | 0.0012 | UG/L | | 30 | UG/KG | h |
| Hexachlorobenzene | 1.1E-05 | 1.6E+00 | 6.0E-03 | 1.70E-03 | 3.89E+03 | NDA | 0.0066 | UG/L | | 800 | UG/KG | h |
| Hexachlorobutadiene | 1.5E-01 | 1.6E+00 | 3.2E+00 | 1.03E-02 | 4.68E+03 | NDA | 0.14 | UG/L | | 100 | UG/KG | h |
| Hexachlorocyclopentadiene | 8.1E-02 | 1.7E+00 | 1.1E+00 | 1.60E-02 | 4.27E+03 | NDA | 0.015 | UG/L | a | 10000 | UG/KG | h |
| Hexachloroethane | 2.1E-01 | NDA | 5.0E+01 | 2.80E-03 | 3.10E-01 | NDA | 0.61 | UG/L | a | 200 | UG/KG | |
| Isodrin | NDA | NDA | NDA | NDA | NDA | NDA | NDA | | | NDA | | |
| Kepone | 3.0E-07 | NDA | 7.6E+00 | 2.50E-08 | 2.45E+03 | NDA | 0.0037 | UG/L | | NDA | | |
| Lead | NA | NA | NA | NA | NA | 8.5 | 15 | UG/L | o | 118 | MG/KG | d |
| Manganese | NA | NA | NA | NA | NA | NDA | 3391 | UG/L | d | 1412 | MG/KG | d |
| Mercury | NA | NA | NA | NA | NA | 0.025 | 1.1 | UG/L | a | 3 | MG/KG | h |
| Methoxychlor | 1.4E-06 | 1.4E+00 | 4.0E-02 | 1.58E-05 | 7.94E+04 | NDA | 18 | UG/L | a | 62000 | UG/KG | h |
| Methyl parathion | 9.6E-06 | NDA | 5.0E+01 | 1.00E-07 | 6.34E+01 | NDA | 0.91 | UG/L | a | 4.1 | UG/KG | a,b |
| 4-Methyl-2-Pentanone (MIBK) | 1.5E+01 | 8.0E-01 | 1.7E+04 | 1.49E-05 | 6.17E+00 | NDA | 290 | UG/L | a | 910 | UG/KG | n |
| Methylene chloride | 3.5E+02 | 1.3E+00 | 2.0E+04 | 2.00E-03 | 2.30E+01 | NDA | 4.1 | UG/L | | 10 | UG/KG | |
| 2-Methylnaphthalene | NDA | 1.0E+00 | 2.5E+01 | NDA | 8.51E+03 | NDA | 150 | UG/L | l | 3000 | UG/KG | l |
| 2-Methylphenol | 2.4E-01 | 1.0E+00 | 2.5E+04 | 1.23E-06 | 2.19E+01 | NDA | 180 | UG/L | a | 600 | UG/KG | a,b |
| 4-Methylphenol | 4.0E-02 | 1.0E+00 | 2.3E+04 | 7.92E-07 | 4.90E+01 | NDA | 18 | UG/L | a | 600 | UG/KG | m |
| Naphthalene | 5.4E-02 | 1.1E+00 | 3.0E+01 | 4.60E-04 | 7.92E+02 | NDA | 150 | UG/L | a | 3000 | UG/KG | a,b |
| Nickel | NA | NA | NA | NA | NA | 8.3 | 73 | UG/L | a | 33.38 | MG/KG | d |
| 4-Nitrophenol | 1.0E-04 | 1.5E+00 | 1.3E+04 | 3.00E-05 | 2.14E+02 | NDA | 230 | UG/L | a | 1670 | UG/KG | n |
| N-Nitroso-di-n-propylamine | 4.0E-01 | 9.2E-01 | 9.9E+03 | 6.92E-06 | 1.02E+01 | NDA | 0.0096 | UG/L | | 0.02 | UG/KG | |
| N-Nitrosodiphenylamine | NDA | NDA | NDA | NDA | NDA | NDA | 14 | UG/L | | 200 | UG/KG | |
| Parathion | 9.7E-06 | NDA | 6.5E+00 | 5.65E-07 | 6.61E+02 | NDA | 22 | UG/L | a | 390 | UG/KG | a,b |
| Pentachlorophenol | 1.1E-04 | 2.0E+00 | 2.0E+01 | 2.10E-06 | 4.09E+02 | 7.9 | 0.56 | UG/L | | 200 | UG/KG | |
| Phenanthrene | 6.8E-04 | 1.2E+00 | 1.0E+00 | 3.90E-05 | 2.29E+04 | NDA | 150 | UG/L | f | 98000 | UG/KG | f |
| Phenol | 2.0E-01 | 1.1E+00 | 8.2E+04 | 2.70E-07 | 2.69E+01 | NDA | 2200 | UG/L | a | 4900 | UG/KG | a,b |
| Pyrene | 2.5E-06 | 1.3E+00 | 1.4E-01 | 1.09E-05 | 6.46E+04 | NDA | 110 | UG/L | a | 140000 | UG/KG | a,b |

Table 5.2.1
Fate and Transport Properties and Screening Levels for Constituents Detected in Soil and Groundwater
NAVBASE-Charleston, Zone H

| Parameter | Vapor Pressure (mm Hg) | Density (g/cm3) | Solubilit (mg/L) | Henry's Law Constant (atm-m3/ mole) | Organic Carbon Water Part. Coeff. (L/kg) | Salt Water Chronic WQC ! (ug/L) | Tap Water RBC or UTL * | Water Units | | Ground Water Protection SSL or UTL ** | Soil Units | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Selenium | NA | NA | NA | NA | NA | 71 | 18 | UG/L | a | 3 | MG/KG | h |
| Silver | NA | NA | NA | NA | NA | NDA | 18 | UG/L | a | NDA | | |
| 2,4,5-T | 7.5E-07 | 1.4E+00 | 2.8E+02 | 8.68E-08 | 2.04E+02 | NDA | 37 | UG/L | a | 260 | UG/KG | n |
| 2,4,5-TP (Silvex) | 5.2E-06 | NDA | 1.4E+02 | 1.31E-07 | 2.57E+03 | NDA | 29 | UG/L | a | 1580 | UG/KG | n |
| Total Petroleum Hydrocarbons (IR | NDA | NDA | NDA | NDA | NDA | NDA | NDA | | | NDA | | |
| Tetrachloroethene | 1.4E+01 | 1.6E+00 | 1.5E+02 | 1.53E-02 | 2.64E+02 | NDA | 1.1 | UG/L | | 40 | UG/KG | |
| Tetrahydrofuran | 1.6E+02 | 8.9E-01 | NDA | 9.63E-03 | 1.95E+00 | NDA | NDA | | | NDA | | |
| Thallium | NA | NA | NA | NA | NA | NDA | 7.66 | UG/L | d | 1.3 | MG/KG | d |
| Tin | NA | NA | NA | NA | NA | NDA | 2200 | UG/L | a | NDA | | |
| Toluene | 2.2E+01 | 8.7E-01 | 5.2E+02 | 6.70E-03 | 1.29E+02 | NDA | 75 | UG/L | a | 5000 | UG/KG | h |
| Toxaphene | 3.3E-05 | 1.6E+00 | 7.4E-01 | 6.30E-02 | 1.51E+03 | 0.0002 | 0.061 | UG/L | | 40 | UG/KG | h |
| 1,2,4-Trichlorobenzene | 4.0E-01 | 1.5E+00 | 3.0E+01 | 2.32E-03 | 1.56E+03 | NDA | 19 | UG/L | a | 2000 | UG/KG | h |
| 1,1,1-Trichloroethane | 1.0E+02 | 1.3E+00 | 1.6E+03 | 1.62E-02 | 1.28E+02 | NDA | 130 | UG/L | a | 900 | UG/KG | h |
| Trichloroethene | 5.8E+01 | 1.5E+00 | 1.1E+03 | 9.10E-03 | 8.70E+01 | NDA | 1.6 | UG/L | | 20 | UG/KG | h |
| Trichlorofluoromethane | 6.9E+02 | 1.5E+00 | 1.1E+03 | 1.10E-01 | 1.59E+02 | NDA | 130 | UG/L | a | 1300 | UG/KG | a,b |
| 2,4,5-Trichlorophenol | NDA | 1.7E+00 | NDA | NDA | NDA | NDA | 370 | UG/L | a | 12000 | UG/KG | a,b |
| 2,4,6-Trichlorophenol | 1.7E-02 | 1.5E+00 | 8.0E+02 | 9.07E-08 | 1.07E+03 | NDA | 6.1 | UG/L | | 50 | UG/KG | |
| 1,2,3-Trichloropropane | 3.1E+00 | 1.4E+00 | 1.8E+03 | 3.44E-04 | 7.24E+01 | NDA | 0.0015 | UG/L | | 0.006 | UG/KG | |
| Vanadium | NA | NA | NA | NA | NA | NDA | 26 | UG/L | a | 131.6 | MG/KG | d |
| Vinyl chloride | 2.6E+03 | 9.1E-01 | 1.1E+03 | 1.22E+00 | 1.10E+01 | NDA | 0.019 | UG/L | | 10 | UG/KG | h |
| Xylene (total) | 8.7E+00 | 8.8E-01 | 2.0E+02 | 7.10E-03 | 2.34E+02 | NDA | 1200 | UG/L | a | 74000 | UG/KG | h |
| Zinc | NA | NA | NA | NA | NA | 86 | 1100 | UG/L | a | 4200 | MG/KG | |

* - Ground water screening concentration which is the greater of:
1. Tap water risk-based concentration as presented in EPA Region III tables (1/31/95)
2. Background upper tolerance limit for shallow groundwater; NAVBASE Charleston - Zone H

** - Soil screening concentration which is the greater of:
1. Soil screening levels which governs soil to water transfer as presented in EPA Region III risk-based concentration tables (1/31/95)
2. Background upper tolerance limit for surface or subsurface soil; NAVBASE Charleston - Zone H

(Risk based screening concentrations assume a target risk of 1E-06, a target hazard index of 0.1, and a dilution attenuation factor of 10)

! - Salt Water Chronic Water Quality Criteria as provided in EPA (1993) Quality Criteria for Water
NA - Not applicable
NDA - No data available
a - based on target hazard index of 0.1
b - target soil leachate concentration based on the tap water RBC
c - acenaphtene used as a surrogate
d - background upper tolerance limit
e - gamma-BHC used as a surrogate
f - fluoranthene used as a surrogate
g - 1,2-dichlorobenzene used as a surrogate
h - target leachate soil concentration based on a MCL
i - value for trans - 1,2-dichloroethene
j - endosulfan used as a surrogate
k - endrin used as a surrogate
l- naphthalene used as a surrogate
m - 2-methylphenol used as a surrogate
n - Calculated using Soil Screening Guidance (EPA 12/94) using contaminant specific values
o - Treatment technique action level for water
p - based on the MCL for total trihalomethanes of 0.08 mg/L
q - benzo(a)anthracene used as a surrogate
r - estimated to be greater than 1000 ug/kg based on structural similarities to 2,4-D
s - Dioxin (TCDD TEQ) soil screening value based on the tap water RBC and site specific soil parameters

Table 5.3.1
Chemicals Detected in Soil
Comparison to Groundwater Protection SSL or Background UTL
NAVBASE-Charleston, Zone H, SWMUs 9,19,20,121 and AOCs 649,650,654

| Parameter | Units | SWMU 19 | | SWMU 20 | | SWMU 121 | | AOC 649,650,651 | | AOC 654 | | Ground-Water Protection SSL | Detected in Ground-water |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil | Surface Soil | Subsurface Soil | | |
| Acenaphthene | ug/kg | 217 | 360 | 210 | ND | 130 | ND | ND | ND | ND | ND | 20000 | I,II |
| Acenaphthylene | ug/kg | ND | 130 | ND | ND | 590 | ND | ND | ND | ND | ND | 20000 | |
| Acetone | ug/kg | 33 | 47 | ND | ND | 193.5 | ND | 25.2 | ND | 4000 | 1700 * | 800 | I,II |
| Acrylonitrile | ug/kg | ND | ND | ND | ND | 34.5 | ND * | 36.9 | ND * | ND | ND | 0.04 | |
| Aluminum | mg/kg | 11900 | 8210 | ND | ND | 16000 | 15500 | 10900 | 3280 | 6890 | 6530 | 46180 | I,II |
| Anthracene | ug/kg | 357 | 670 | 450 | 170 | 610 | ND | 250 | ND | ND | 130 | 430000 | |
| Antimony | mg/kg | 726 | 1.4 | ND | ND | 7.3 | ND | 1.6 | ND | ND | ND | NDA | I (x) |
| Aroclor-1248 | ug/kg | ND | ND | ND | ND | 160 | 37 | 52 | 30 | ND | ND | 8200 | |
| Aroclor-1254 | ug/kg | 2300 | ND | ND | ND | 4300 | 82 | 407 | 30 | ND | ND | 8200 | |
| Aroclor-1260 | ug/kg | 560 | ND | ND | ND | 1100 | 88 | ND | ND | ND | ND | 8200 | |
| Arsenic | mg/kg | 22.1 | 8.3 | ND | ND | 18.7 | 10.7 | 9.5 | 3 | 7.7 | 18.4 | 35.52 | I,II (x) |
| delta-BHC | ug/kg | ND | ND | ND | ND | ND | ND | ND | ND | 1.2 | ND | 6 | |
| Barium | mg/kg | 128 | 64.1 * | ND | ND | 530 | 89.7 * | 57.9 | ND * | 38.7 | ND | 43.8 | I,II (x) |
| Benzene | ug/kg | 64 | ND * | ND | ND | ND | ND | ND | ND | ND | ND | 20 | I,II (x) |
| Benzo(g,h,i)perylene | ug/kg | 215 | 600 | 250 | ND | 780 | 93 | 1100 | ND | ND | ND | 98000 | |
| Benzo(a)pyrene | ug/kg | 604 | 1400 | 820 | 430 | 1700 | 200 | 2000 | ND | ND | ND | 4000 | |
| Benzo(a)anthracene | ug/kg | 811 | 1700 * | 950 | 580 * | 1900 | 160 * | 1900 | ND * | ND | 140 | 700 | |
| Benzo(b)fluoranthene | ug/kg | 935 | 1700 | 1400 | 680 | 2700 | 200 | 4000 | ND | 110 | ND | 4000 | |
| Benzo(k)fluoranthene | ug/kg | 712 | 1200 | 660 | 400 | 2200 | 230 | 130 | ND | ND | 140 | 4000 | |
| Chrysene | ug/kg | 755 | 1600 * | 940 | 610 | 2000 | 170 * | 1900 | ND * | ND | ND | 1000 | |
| Dibenzo(a,h)anthracene | ug/kg | ND | 250 | 100 | ND | 280 | ND | 390 | ND | ND | ND | 11000 | |
| Indeno(1,2,3-cd)pyrene | ug/kg | 240 | 590 | 260 | ND | 750 | ND | 910 | ND | ND | ND | 35000 | |
| Benzoic acid | ug/kg | ND | ND | ND | ND | ND | ND | 269 | ND | ND | ND | 28000 | I |
| Beryllium | mg/kg | 3 | 0.61 | ND | ND | 14.6 | 2.6 | 1.1 | 0.2 | 0.49 | 0.59 | 180 | II (x) |
| 2-Butanone (MEK) | ug/kg | ND | ND | ND | ND | 37.1 | ND | ND | ND | ND | ND | 570 | I |
| Butylbenzylphthalate | ug/kg | 2300 | 150 | 190 | 430 | 2600 | ND | 1540 | ND | ND | ND | 6800 | II |
| Cadmium | mg/kg | 1.8 | 0.64 | ND | ND | 2.5 | ND | 0.39 | ND | 0.97 | 1.5 | 6 | I,II |
| Carbon disulfide | ug/kg | 9.9 | ND | ND | ND | ND | ND | 4.8 | ND | ND | 11 | 1400 | I,II (x) |
| alpha-Chlordane | ug/kg | 9.35 | ND | ND | ND | ND | ND | 11.6 | 2 | 69.1 | ND | 2000 | |
| gamma-Chlordane | ug/kg | 4 | ND | ND | ND | 4 | ND | 6 | ND | 41 | ND | 2000 | |
| Chlorobenzene | ug/kg | 64 | ND * | ND | ND | ND | ND | 5.18 | ND | ND | ND | 60 | I,II (x) |
| Chloroform | ug/kg | 1.5 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 300 | |
| Chromium | mg/kg | 49.2 | 20.7 | ND | ND | 210 | 50.8 * | 24.4 | 12.3 | 53.3 | 70.7 | 85.65 | I,II (x) |
| Cobalt | mg/kg | 43.3 | 5.5 * | ND | ND | 97.2 | 15.9 * | 9.5 | 1.5 | 3.1 | 4.3 | 14.88 | I,II |
| Copper | mg/kg | 3040 | 309 * | ND | ND | 4060 | 680 * | 357 | 24.6 * | 57.1 | 13.1 * | 31.62 | I,II (x) |
| Cyanide | mg/kg | ND | ND | ND | ND | 9.9 | ND | ND | ND | 2 | 1 | NDA | |
| 2,4-D | ug/kg | 41.8 | ND | ND | ND | ND | ND | ND | ND | ND | ND | 1700 | |
| 4,4'-DDD | ug/kg | 6 | 10 | ND | ND | ND | ND | 8 | ND | ND | ND | 700 | II |
| 4,4'-DDE | ug/kg | 5 | 12 | ND | ND | 20.5 | ND | 10.2 | 3 | 6.15 | ND | 500 | II |
| 4,4'-DDT | ug/kg | 16 | ND | ND | ND | 14 | ND | 7 | ND | 10 | ND | 1000 | I |
| Dibenzofuran | ug/kg | 124 | 200 | 220 | ND | 89 | ND | 56.5 | ND | ND | ND | 12000 | I,II |
| Diethylphthalate | ug/kg | ND | ND | ND | ND | 85.2 | ND | ND | ND | ND | ND | 11000 | I |
| Di-n-butylphthalate | ug/kg | 1100 | ND | ND | ND | ND | ND | 222 | ND | ND | ND | 12000 | I,II |

South Car
# DHEC
Department of Health and Environmental Control
2600 Bull Street, Columbia, SC 29201-1708



Mr. Gabriel L. Magwood
Southern Division NFEC
P.O. Box 190010
2155 Eagle Drive
North Charleston, South Carolina 29419-9010

Re: Document: Proposed Soil Corrective Action Plan (SCAP) for Contaminated Soil at the Charleston Naval Complex, dated July 18, 1996
CNB (general)
Charleston County

Date: October 17, 1996

Dear Mr. Magwood:

The author has completed technical review of the referenced submittal. It is recognized that the intent of the document is to provide a general task statement for the handling of soils resultant from tank removals at the facility. Although the proposal to utilize Risk-Based Screening Levels (RBSL) as a Pass/Fail criteria for excavated soils disposition appears reasonable, several concerns have been identified with the proposal as submitted. In this regard, the following comments and/or recommendations are provided for your consideration:

- The requirement for investigation and remediation of known releases is covered under Title 48 (Environmental Protection and Conservation), Chapter 1 (Pollution Control Act, PCA). Further, facilities with known or suspected releases from underground storage systems (i.e. tanks) must comply with R.61-92, Part 280 (Underground Storage Tank Control Regulations) Subpart F (Release response and corrective action...). In consideration to the above, appropriate assessments of the excavation should be conducted to determine the extent and severity, if any, of potential residual contamination. The document as submitted does not provide procedures and methodologies for the assessment(s) noted above, either directly or through reference. It seems appropriate to consider the condition of the tank excavation bottom (i.e. impacted or no impacts) in determining final disposition for excavated materials.

- Consistent with the above, the document fails to provide a decision matrix for determining the extent of soils excavation required to justify closure of each tank pit under the USTCR or PCA, as appropriate.

- The proposed sampling list for chemicals of concern should incorporate all polyaromatic hydrocarbons (PAH) identified in the Drinking Water Regulations and Health Advisories, as published by the Environmental Protection Agency.

- The document fails to provide for appropriate reporting and/or documentation technically justifying a choosen course of action for each site.

- The document fails to provide for appropriate sampling/analysis and disposal of collected leachate, if any, generated during remedial endeavors.

DEPARTMENT OF THE NAVY
SOUTHERN DIVISION
NAVAL FACILITIES ENGINEERING COMMAND
P.O. BOX 190010
2155 EAGLE DRIVE
NORTH CHARLESTON, S.C. 29419-9010

Li 8.15.96
Lo 10.17.96

5090
Code 1849
18 July 1996

General

Mr. Paul Bristol
South Carolina Department of Health
and Environmental Control
Ground-Water Protection Division
2600 Bull Street
Columbia, SC 29201

**PROPOSED SOIL CORRECTIVE ACTION PLAN FOR CONTAMINATED SOIL AT THE CHARLESTON NAVAL COMPLEX**

Dear Mr. Bristol:

The purpose of the proposed soil corrective action plan is to present a plan of action for mitigating petroleum contaminated soils at the Charleston Naval Complex. Enclosed is the soil corrective action plan (SCAP) for the underground storage tank sites at the Charleston Naval Complex, Charleston, South Carolina. The SCAP also addresses a pilot study bioremediation plan for petroleum contaminated soil. If you have any questions please contact me at 803-820-7307.

Sincerely,

GABRIEL L. MAGWOOD
Petroleum/UST Branch

RECEIVED

JUL 29 1996

Groundwater Protection
Division

Draft Letter 9.16.96
Draft Letter 10.16.96

# PLAN FOR EXCAVATED SOIL FROM PETROLEUM TANK SITES

Supervisor of Shipbuilding, Conversion and Repair, USN, Portsmouth, VA, Environmental Detachment Charleston (DET) has been tasked to remove a large number of petroleum tanks as part of the Charleston Naval Base remediation program. During this removal process a significant amount of soil will be excavated. The proposed methods of disposition of the soil are based on the the risk based screening levels (RBSLs) which are outlined in the South Carolina Department of Health and Environmental Control (DHEC) "Risk Based Corrective Action For Petroleum Releases" (RBCA) dated June 1995.
Soils from the tank excavation will be sampled for the following chemicals of concern (COCs)as listed in RBCA, Table 6: BTEX - benzene, toluene, ethylbenzene, xylenes; naphthalene; and the polynuclear aromatic hydrocarbons (PAH)- benzo(a)anthracene, benzo(b)flouranthene, benzo(k)flouranthene, chrysene, and dibenz(a,h)anthracene . Generally, the sample results will be compared to the RBCA, Table 6, RBSLs using the "< 5ft depth to ground water" column concentrations as an action level for the excavated soils. For some sites, RBSLs may also be determined, using the appropriate "Risk Based Screening Levels Look-up Tables" based on site conditions.
The following actions will be taken based on the COC concentrations in the excavated soils:



(a) All COCs below the RBSLs and no known non-petroleum contaminants -- no remediation required, soil will be returned to the excavation.

(b) Any COCs above the RBSLs and no known non-petroleum contaminants -- bioremediate to levels below the RBSLs and reuse.

(c) Known non-petroleum contaminants exceeding an applicable limit or if option (a) or (b) is not desirable -- transfer to a contractor for disposal as waste.

Soils excavated from waste oil UST sites will not be considered for bioremediation. If the COCs are below the RBSLs and all metals are below RCRA limits, the soil be returned to the excavation. If any COCs are above the RBSL, or one or more metals are above the RCRA limits, the soil will be disposed of as waste per South Carolina Code of Regulations (R.) 61-79.261.

Excavated soils which are determined to be waste will be accumulated on site in containments at Building 1601 prior to disposal. These waste soils will be segregated based on the type of contamination. Soils that are contaminated with petroleum products (BTEX, and PAHs) will be separated from soils that are contaminated with RCRA (hazardous) constituents. All waste soils will be properly disposed of at a DHEC permitted treatment or disposal facility.

For the bioremediation phase of this plan, DET proposes using a unique approach. A standard bioremediation plan requires a detailed treatment method for an excavation site based on predetermined contamination and soil conditions, as well as other site specific information. Due to the number of sites, the small quantities (as little as a few cubic feet) of soil from most sites, and the nonavailability of most site specific data until after tank removal, normal procedures for establishing a bioremediation plan would prohibit bioremediation as a feasible treatment. Therefore the following plan is submitted.

The major elements of this plan include:

PURPOSE:

Determine the feasibility of the bioremediation of petroleum contaminated soil excavated in small lots from various sites to a cleanup level of at least the RBSLs of the RBCA.

SOIL:

Only petroleum contaminated soil not known or suspected of other contamination would be treated. Soil meeting this requirement may also be rejected based on some characteristic (i.e., clay content, concentration level, etc.). Waste or used oil impregnated soil would not be treated based on the probability of other contamination being present (i.e., heavy metals). Gasoline contaminated soil may be excluded depending on the effect of the increased volatile organic compound (VOC) rate on monitoring and ventilation.

SITE:

To minimize runoff problems, the bioremediation will be done in Building 1601, a well ventilated fully enclosed 80,000 sqft warehouse. The building has a concrete floor and is constructed such that portions of the foundation will serve as a sufficient berm.

Site preparations will include:

(a) removal of deteriorated lead based paint from the ceiling and interior walls
(b) operational testing of the ventilation system
(c) inspection/repair of any obvious floor cracks
(d) installation of overhead irrigation system

Due to site construction a liner is not considered necessary and, where tilling operations are proposed, would not be practical. Any runoff/leachate will be collected using a simple vacuum process.

The existing ventilation system will produce a ground level discharge which is considered acceptable. Also, based on expected VOC levels being less than 1000 lbs/month, an air permit is not considered to be required. No other permits are considered applicable.

PROCESS:

Initial Screening - Each lot (minimum of 20 cubic yards from one or more sites) will be sampled (if not already done during excavation) to determine contamination levels and soil conditions.

Mixing/Initial Treatment - based on the above results, pH may be adjusted and other soil condition improvements made. These could include adding nutrients, water, and/or compost (manure, wood chips, or other material). The treated lot will be mixed to obtain a more homogeneous soil matrix.

Treatment - use any method below after starting a windrow/pile or increasing height, width and/or length of an existing one. Planned size of a windrow/pile: up to two foot deep with width and length to suit. A minimum of one windrow/pile for each method used will be established.

Method A: tilling at least once per month

Method B: tilling at least once per month and maintaining moisture control (based on visual inspection or sampling)

Method C: same as method B plus the monitoring and adjustment of various soil conditions which may include nutrients content, pH, microbial population and/or others.

Method D: (OPTIONAL) same as method C except air will be supplied to/extracted from the windrow without tilling. This will be accomplished using a piping system within the windrow/pile connected to an appropriately sized blower assembly.

SAMPLING/MONITORING:

Safety - The levels of volatile and semi-volatile compound concentrations are not expected to present any hazards or require any personal protection equipment (PPE). However, appropriate PPE will be used until air monitoring performed during initial operations prove otherwise.

Soil -Prior to starting the treatment period, a minimum of one composite sample will be taken of the new lot and analyzed for RBCA Table 6 COCs.
During treatment, immunoassy technology will be used to monitor for total petroleum hydrocarbons (TPH). This method of testing will be used due to the significant cost reduction of testing to provide an indication of the bioremediation progress. Optional sampling/monitoring for soil nutrient conditions, pH, oxygen/ carbon dioxide, moisture, and microbial population may be done dependent on the method and other factors. Also for method D, the extracted air may be monitored for various conditions (i.e., oxygen, carbon dioxide, etc.).
For final testing of the soil, a minimum of one composite sample will be taken from each windrow / pile. For those exceeding 10 cubic yards, an addition sample will be taken for each additional ten cubic yards. Final testing will be analyzed for RBCA Table 6 COCs by a state certified laboratory.
Soil at or less than the Table 6, "< 5ft depth to ground water" column levels will be considered acceptable for unrestricted reuse. For soil not meeting these levels additional bioremediation will the performed and the soil retested or the soil may be reused in restricted applications. The restriction would exclude reuse at Table 6, "< 5ft depth to ground water" column sites, but would allow reuse at any other sites of Table 6 or the sandy sites of Table 5 provided the bioremediated soil meets the requirements for that type soil.

DURATION:

Up to six months, during and after which the results will be evaluated to determine the best methodology, is considered necessary. Based on this evaluation a new plan for continued and/or expanded operation will be submitted.